Proceedings of the Conference on

Wildlife Reintroduction & Habitat Restoration in Pennsylvania

PENNSYLVANIA STATE LIBRARY
DOCUMENTS SECTION

October 28, 1995 *The Pittsburgh Zoo*

Digitized by the Internet Archive
in 2017 with funding from
This project is made possible by a grant from the Institute of Museum and Library Services as administered by the Pennsylvania Department of Education through the Office of Commonwealth Libraries

https://archive.org/details/proceedingsofcon00conf_10

Proceedings on the Conference on

Wildlife Reintroduction & Habitat Restoration in Pennsylvania

October 28, 1995

Co-sponsored by the **Sierra Club (Allegheny Group)**,
The Pittsburgh Zoo
and the **Audubon Society of Western Pennsylvania**
with the generous assistance of
The Wild Resource Conservation Fund of Pennsylvania

Cover and Text are printed on Recycled Paper.

Proceedings on the Conference on

Wildlife Reintroduction & Habitat Restoration *in Pennsylvania*

Table of Contents

Page

Introduction and Statement of Purpose, by Donald L. Gibbon 1

Keynote Remarks, presented by Terry Tempest Williams, including the essay, "Drought" by Barry Lopez. 2

Wildlife Reintroduction from the Zoo's Point of View, by Lee Nesler, General Curator, Pittsburgh Zoo 5

River Otter and Fisher Reintroduction in Pennsylvania, by Thomas L. Serfass, PhD, School of Forest Resources, Pennsylvania State University 7

The French Creek Project: The Public Education Approach to Watershed Protection, by Brian Hill, Project Director 9

Bluebirds - a Success Story, by Nick Kerlin, Park Manager, World's End State Park, Pa Bureau of State Parks 12

Osprey Restoration at Moraine State Park: Involving the Community in the Restoration Process, by Chuck Tague, Naturalist/Editor, The Nature Observer News 14

American Shad Restoration in the Susquehanna River Watershed, by Michael L. Hendricks, PA Fish and Boat Commission 16

Biological Control of Purple Loosestrife in Pennsylvania, by Bradley J. Gochnauer, Landstudies, Inc. 19

Eastern Old Growth Forests, by Sam Hays, PhD, Environmental Historian 21

Wetland Restoration: Correcting the Past, by Shayne Hoachlander and Barry Zafuto, PA Game Commission 24

The Realities of Timber Harvesting and Forest Stewardship from the Point of View of an Award-Winning Timber Company, by Blaine A. Puller and Ned Karger, Kane Hardwoods (A Division of The Collins Pine Company) 26

CONTENTS

Page

Restoration of Rattlesnake Habitat in Pennsylvania, ... 29
by William B. Allen, Herpetologist

Pennsylvania's Wild Turkey Management Program: A Success Story, by William E. Drake, PA Game Commission 31

Restoring Grassland Habitats in Pennsylvania, ... 33
by Richard Belding, PA Game Commission

Transportation Impacts on Biodiversity: Development of Methodology to Assess When Concern is necessary, ... 35
by Cynthia Bardman (Greenhorne and O'Mara, Inc.) and George Reese (GAI, Inc.)

The Role of the Wild Resource Conservation Fund: How it Helps in the Implementation of Restoration Projects, ... 37
by Frank Felbaum, Executive Director

INTRODUCTION & STATEMENT OF PURPOSE

Donald L. Gibbon, Adjunct Professor, Rachel Carson Institute
Chatham College, 205 Elysian Street, Pittsburgh, PA 15206
412-494-8585(o)/-8715(fax)/362-8451(home)

The seeds from which this Conference grew were planted some five years ago. Over the last several years the Allegheny Group of the Sierra Club has organized a series of forest-and-wildife conferences, including "The Future of the Forest" at the Carnegie Museum of Natural History in March, 1991, a Regional Conference on Biodiversity at the Museum in April, 1992, and "Endangered Species, Endangered Habitats, and Your Own Backyard", at the Pittsburgh Zoo in October, 1994. Each of these conferences was co-sponsored by other organizations committed to similar ends, including the Audubon Society of Western Pennsylvania, the Pennsylvania Alliance for Environmental Education, the Western Pennsylvania Conservancy, the Wild Resource Conservation Fund and the host institutions.

In each case, the most highly qualified speakers were brought in to address topics of broad interest, audiences came and feasted on their words and illustrations... and then everyone went home. The conferences were followed by a resounding silence, a great feeling of emptiness. A few hundred people had been energized briefly by messages so vital that they should have been heard by millions. The gap between what was and what should have been was huge, and hugely disappointing.

This gap is being partly filled by these Proceedings. Once again, we have gathered an exemplary cadre of speakers, to cover an extraordinary array of important and interesting topics. The meeting rooms were filled, the audiences were appreciative... but this time we have a record of what went on! This time we are publishing brief summaries of the presentations, along with many addresses and phone numbers of active workers, organizations and agencies in these many areas, so that others can tap into these reservoirs of information and experience.

In this instance the immediate motivation for the Conference was my astonished pleasure at reading an early issue of "Wild Notes," the publication of Pennsylvania's Wild Resource Conservation Fund, directed by Frank Felbaum (see Section 17 in this volume for a summary of the Fund's activities in the area of restoration of wildlife and habitat). I was delighted to read of the broad array of important projects being supported by the Fund, and felt it important to gather many of the project directors and others in the field to share this excitement with the public.

It is our hope that this published record will enable other researchers and activists to network more effectively, and for wildlife agencies in other states to be in touch with their counterparts here in Pennsylvania. The work being done hardly begins to fill the need. But, while we can't do everything, we can do something. These good people are putting their lives and careers on the line on behalf of the natural world. We are in their debt. This Proceedings volume is dedicated to them, in deep thanks for their work on behalf of our "Wild Resources".

KEYNOTES REMARKS

Terry Tempest Williams, Author-Naturalist,
3499 East Little Tree Rd., Salt Lake City, UT 84108
801-582-4521

Terry Tempest Williams can perhaps best be introduced, if you do not already have the pleasure of knowing her or her work, by the fact that the Utne Reader has selected her to be on their list of "The 100 Most Thoughtful People of Our Time" . Ms. Williams' sensitivity to the important details of life and her ability to articulate why they are important to her are a continual source of delight. Her life is filled with "numinous experiences" that most of us would simply miss in passing. She has an amazing capacity to put herself in places where critical events are going to occur...events that the ordinary person.. most of us... would not have recognized as critical.

Perhaps above all Ms. Williams is a naturalist. But that doesn't mean she is obsessed with naming, classifying, dissecting. What is does mean is that she is touched deeply by the natural world around her. And she sees connections. John Muir's blinding perception that "when we try to pick out anything in the Universe, we find it connected to everything else", could perhaps be a description of her life's work. Who else would have the nerve and the intuition that would allow her to write of the drowning of a favorite natural area and the death of her mother from cancer in a single volume? And who else would have the skill and sensitivity to make the book a revelatory and joyful experience? (See her book, "Refuge").

With all this in mind, we invited Terry Tempest Williams to be the keynote speaker at the Conference on Restoration of Wildlife and Habitat. The night before, she had given a well-attended public lecture on "Reflections on Loss and Restoration", at Chatham College. And in a most amazing act of graciousness, Ms. Williams deferred to Barry Lopez in her Conference presentation. She found that his short essay, "Drought", originally published in River Notes, perfectly filled the bill for the day's Conference. So she read that to us instead of presenting her own work. I believe you will find she was right.

But lest you miss out on Ms. Williams' work, we would suggest that you search out "Refuge", "An Unspoken Hunger" and "Desert Quartet", for a recent selection of her writings. You will be richly rewarded.

"Drought"

From "River Notes" by Barry Lopez
Reprinted with permission. @1979 by Barry Holstun Lopez

I awoke one night and thought I heard rain - it was the dry needles of fir trees falling on the roof. Men with an intolerable air of condolence have appeared, as though drawn by the smell of death, dressed comfortably, speaking in a manipulated tongue, terminally evil. They have inquired into the purchase of our homes. And reporters come and go, outraged over the absence of brown trout, which have never been here. The river like some great whale lies dying in the forest.

In the years we have been here I have trained myself to listen to the river, not in the belief that I could understand what it said, but only from one day to the next to know its fate. The river's language arose principally from two facts: the slightest change in its depth brought it into contact with a different portion of the stones along its edges and the rocks and boulders mid-stream that lay in its way, and so changed its tone; and although its movement around one object may seem uniform at any one time, it is in fact changeable. Added to these major variations are the landings of innumerable insects on its surface, the breaking of its waters by fish, the falling into it of leaves and twigs, the sloshing of raccoons, the footfalls of deer; ultimately these are only commentary on the river's endless reading of the surface of the earth over which it flows.

It was in this way that I learned before anyone else of the coming drought. Day after day as the river fell by imperceptible increments its song changed, notes came that were unknown to me. I mentioned this to no one, but each morning when I awoke I went immediately to the river's edge and listened. It was as though I could hear the sound rain begins to make in a country where it is not going to come for a long time.

As the water fell, however, nothing unexpected was uncovered, although the effect of standing in areas once buried beneath the roar of the river's current was unsettling. I found only one made object, a wheel, the kind you find on the back of a child's tricycle. But I didn't look as closely as the others. The wailing of the river over its last stones was difficult to bear, yet it was this that drew me back each day, as one visits those dying hopelessly in a hospital room. During those few hours each morning I would catch stranded fish barehanded in shallow pools and release them where the river still flowed. The bleaching of algae once waving green underwater to white; river stones once cool now hot to the touch and dry; spider webs stretched where there had been salmon eggs; snakes where there had been trout - it was as though the river had been abandoned.

During those summer days, absorbed with the death of the river and irritated at the irreverent humour of weather forecasters in distant cities, I retreated into a state of isolation. I fasted and abstained as much as I felt appropriate from water. These were only gestures, of course, but even as a boy I knew a gesture might mean life or death, and I believed the universe was similarly triggered.

From this point on, the song that came out of the river did not bother me as much. I sat out of the way of the pounding sun, in dark rocks shaded by the overhanging branches of alders along the bank. Their dry leaves, stirred by the breeze, fell brittle and pale around me. I slept on the bank regularly now. I would say very simple prayers in the evening, only an expression of camaraderie, stretching my fingers gently into the darkness toward the inchoate source of the river's strangulation. I did not beg. There was a power to dying, and it should be done with grace. I was only making a gesture on the shore, a speck in the steep, brutal dryness of the valley by a dying river.

In moments of great depression, of an unfathomable compassion in myself, I would make the agonized and tentative movements of a dance, like a long-legged bird. I would exhort the river.

What death we saw. Garter snakes stiff as a twig in the rocks. Trees (young ones, too young) crying out in the night, shuddering, dropping all their leaves. Farther from the river, birds falling dead in thickets, animals dead on the paths, their hands stiffened in gestures of bewilderment and beseeching; the color gone out of the eyes of any creature you met, for whom, out of respect, you would step off the path to allow to pass.

Where a trickle of water still flowed there was an atmosphere of truce, more dangerous than one might imagine. As deer and coyote sipped from the same tiny pool they abbrogated their agreement, and the deer contemplated the loss of the coyote as he would the loss of a friend; for the enemy, like the friend, made you strong. I was alert for such moments, for they were augury, but I was as wary of them as of any lesson learned in death.

One moonlit evening I dreamed of a certain fish. The fish was gray-green against light-colored stones at the bottom of a deep pool, breathing a slow unperturbed breathing, the largest fish I had ever imagined living in the river. The sparkling of the water around him and the sound of its cascading over the creek bed made me weak and I awoke suddenly, convulsed. I knew the fish. I knew the place. I set out immediately.

The dry riverbed was only a clatter of teetering stones now, ricocheting off my feet as I passed, bone weary, feeling disarmed by hunger, by the dimness of the night, and by the irrefutable wisdom and utter foolishness of what I was doing. As I drew near the mouth of the creek the fish began to loom larger and larger and I could feel - as though my hands were extended to a piece of cloth flapping in the darkness - both the hope and the futility of such acts.

I found the spot where the creek came in and went up it. I had seen the fish in a deep pool below a rapids where he had fed himself too well and grown too large to escape. There was a flow of night air coming down the creek bed, rattling dry leaves. In the faint moonlight a thousand harlequin beetles suddenly settled on my clothing and I knew how close I was to a loss of conviction, to rage, to hurling what beliefs I had like a handful of pebbles into the bushes.

The beetles clung to the cloth, moved through my hair, came into the cups of my hands as I walked, and as suddenly were gone, and the area I stood in was familiar, the fish before me. The rapids were gone. The pool had become a pit. In its lowest depression the huge fish lay motionless, but for the faint lifting of a gill cover. I climbed down to him and wrapped him in my shirt, soaked in the pool. I had expected, I think, a fight, to be punched in that pit by the fish who lay now in my arms like a cold lung.

Climbing out of there, stopping wherever I could to put his head under in some miserable pool, hurrying. I came to the river and the last trickle of water, where I released him without ceremony.

I knew, as I had known in the dream, the danger I was in but I knew, too, that without such an act of self-assertion no act of humility had meaning.

By now the river was only a whisper. I stood at the indistinct edge and exhorted what lay beyond the river, which now seemed more real than the river itself. With no more strength than is in a bundle of sticks I tried to dance, to dance the dance of the long legged-birds who lived in the shallows. I danced because I could not think of anything more beautiful.

The turning came during the first days of winter. Lynx came down from the north to what was left of the river. Deer were with him. And from some other direction Raccon and Porcupine. And from downriver Weasel and White-footed Mouse, and from above Blue Heron and Goshawk. Badger came up out of the ground with Mole. They stood near me in staring silence and I was afraid to move. Finally Blue Heron spoke: We were the first people here. We gave away all the ways of living. No one remembers how to live any more, so the river is drying up. Before we could ask for rain there had to be someone to do something completely selfless, with no hope of success. You went after that fish, and then at the end you were trying to dance. A person cannot be afraid of being foolish. For everything, every gesture, is sacred.

"Now, stand up and learn this dance. It is going to rain."

We danced together on the bank. And the songs we danced to were the river songs I remembered from long ago. We danced until I could not understand the words but only the sounds, and the sounds were unmistakably the sound rain makes when it is getting ready to come into a country.

I awoke in harsh light one morning, moved back into the trees and fell asleep again. I awoke later to what I thought were fir needles falling on my cheeks, but these were drops of rain.

It rained for weeks. Not hard, but steadily. The river came back easily. There were no floods. People said it was a blessing. They offered explanations enough. Backs were clapped, reputations lost and made, the seeds of future argument and betrayal sown, wounds suffered and allowed, pride displayed. It was no different from any other birth but for a lack of joy and, for that, stranger than anything you can imagine, inhuman and presumptuous. But people go their way, and with reason; and the hardness for some is all but unfathomable, and so begs forgiveness. Everyone has to learn how to die, that song, that dance, alone and in time.

The river has come back to fit between its banks. To stick your hands into the river is to feel the cords that bind the earth together in one piece. The sound of it at a distance is like wild horses in a canyon, going sure-footed away from the smell of a cougar come to them faintly on the wind.

WILDLIFE REINTRODUCTION: From the Zoo's Point of View

Lee Nesler, General Curator, Pittsburgh Zoo
PO Box 5250, Pittsburgh, PA 15206
412-665-3639/-366-1363(fax)

When zoos first started they were just collections of wild animals, known as menageries, the more variety the better. Most of the specimens were captured from the wild, often in groups at the same time and place, minimizing the genetic diversity since most individuals were related to one another.

Zoos were not set up to be breeding facilities. The animals were housed close together, in cages of concrete, glass and steel bars. Sometimes predators were next door to prey. These were not the conditions animals need to reproduce and successfully raise their young in captivity. In fact, those conditions were not even yet well known to their keepers.

But zoos have begun to change their tune. Most zoos now have a well-thought-out mission statement built around conservation, education and research, and exhibits are designed with breeding programs in mind. This often includes some privacy needed by the animals for reproduction and care of their offspring.

In "Zoo-topia" there would be enough space to maintain viable populations of all the threatened and endangered species. But in the real world, if all the professionally-run zoos and aquariums were combined, they would fit in the space of Brooklyn, NY! There just isn't enough space to do everything.

Reintroduction has been a conservation tool on which zoos have been banking for many years. Zoos have been trying to maintain the genetic diversity of species for over 200 years, with the intention of reintroducing as many species as possible to the wild. Unfortunately with the closed captive populations that are available in the United States, success in these areas is far from certain.

We have been optimistic that the countries of origin would maintain the habitat while we struggled to maintain viable populations of threatened and endangered species and set up captive breeding programs. But unfortunately, the habitat continues to be destroyed as the breeding efforts are being established.

In spite of obstacles, the American Zoo and Aquarium Association has set up Species Survival Plans (SSP) for the controlled breeding and management of threatened and endangered species. Examples of animals included in such programs are: spectacled bears, cheetah, chimpanzee, African and Asian elephants, gibbons, lemurs, snow leopards, African lion, orangutan, scimitar-horned and Arabian oryx, rhino, tamarin, tiger, tree kangaroo, wolves and Grevy's zebra...to name just a few!

The overall SSP program includes the following components:

1. Educating the public about endangered animals and the roles they play in their ecological systems.
2. Conducting veterinary, nutritional, reproductive and other research in support of both captive and wild populations, and developing and testing technologies that can be applied in the field in these areas.
3. Providing a refuge for species under immediate threat from human activity and/or habitat destruction, until wild populations can be stabilized or re-established.

Each SSP has a species coordinator who manages the propagation of hundreds of animals located in facilities throughout the world. The coordinators must have skills in computers, genetics and exotic animal husbandry, and have time and energy to devote to correspondence, travel and data-base management. They work with many others within the Association, such as taxon advisors who are experts on particular taxa, studbook keepers who are keep track of a single species' reproductive history, and researchers in the field and at zoos who are studying different aspects of the species biology.

Studbook keepers maintain records of living and dead animals, to maintain up-to-date knowledge of the genetic history of the living population. Analysis of this information enables determination of the genetic importance of each individual to the whole population.

The responsibility to an animal in captivity does not end with meeting its daily physiological needs, but extends to managing the genetics and demographics. Genetics determines the number of "founders" within a population and whether or not more animals need to be brought in to decrease inbreeding. New animals may be brought in from far away, even Europe. Often delicate decisions have to be made as to the impact of removing more animals from the wild and whether that will detrimentally impact fragile wild populations.

Breeding recommendations are made after the entire population is carefully evaluated. When a zoo petitions the AZA to join an SSP, it signs a memorandum of participation agreeing that it will abide by recommendations made for it. All the animals within an SSP are part of an annual master plan, including whether or not individuals should be bred and with whom.

Perhaps the plan calls for a particular animal not to be bred at all. This would be accomplished by choosing from a whole range of techniques, including sterilization, reversible birth control, or separation. For example, an implant may be used with a female orangutan to prevent a female who is well represented in the population from having more offspring. A wolf or lemur might be removed from the population during a seasonal estrus.

Reintroduction is the attempt to re-establish a species in an area that once was a part of its historic range. The end result of any program has to be a viable population of the animal in a functioning ecosystem. Sources of stock for reintroduction may be from wild animals in other parts of the range or from captive stock. This latter approach is expensive and risky, and is generally not the most cost-effective strategy. For example, the wolves re-established in Yellowstone came from wild populations in Canada, rather than from captive breeding programs.

But should the decision be made to use captive stock, it must be surplus to the genetic and demographic needs of the SSP. Reintroduction is a new "science", and any program must include thorough evaluation of the effort. The protocols are based on conditioning the animals for survival in the wild. This conditioning may include "mock release" within a zoo. Individuals who do well in this "mock release" are good candidates for complete release. For example, several zoos have become "free-range" for tamarins. These three pound primates are fitted with radio collars for tracking. set out in nest boxes similar to their natural nests in Brazil, and released. The public enjoys seeing these liberated tamarins run through the trees and pathways.

Unfortunately the safety of an exhibit develops a false sense of security for captive animals, including habituation to humans. Predators to be reintroduced need specially careful isolation from humans so that they will not associate with human populations later. For example, the red wolf SSP maintains a strict husbandry protocol. The animal you house today may raise pups to be released, so wolf-human interactions need to be carefully managed.

The black-footed ferret is an American species that actually went extinct in the wild. Reduced to 17 individuals, all were removed to zoos. The ferret SSP is part of the US Fish and Wildlife Service's recovery plan for these animals. Concern was expressed over the possible reaction of the ferret to its major predator, the badger. An elaborate ruse was played, creating an electric-car-mounted road-kill badger, to which Siberian ferrets (not endangered) were exposed; because of their appropriate response to the fake badger, it was assumed that fear of predators remained strong. It was found that adolescent ferrets adapted to the wild better than adults, suggesting that extensive training may not be necessary. Raising the ferrets in artificial prairie-dog towns, allowing them to feed on live prairie-dogs, also increased success on release.

Since most prairie dog towns have been obliterated, cooperation between ranchers in Wyoming and government agencies is going to have to be extensive and long-term. But early efforts in 1991 and 1993 have great promise, with several litters born in the wild.

Size is an important factor in reintroduction. A three-pound primate is easier to reintroduce than a mega vertebrate. Conservation should go forward both in the wild and in captivity. Should new genetic stock be necessary for the captive program, it is better to transport the gametes than remove the stock from the wild.

Clearly zoos have come a long way in the last 50 years. Medical and reproductive advances parallel the new understandings and make the work more likely to succeed. And success breeds success.

For more information on this general subject, please contact:

The American Zoo and Aquarium Association (AZA), 7470-D Old Georgetown Road, Bethesda, MD 20814 (301-907-7777)

Also refer to:

Wiese, Robert and Michael Hethins, (1994) Species Survival Plans: Strategies for Wildlife Conservation, Chapter 4, Am. Zoo and Aquarium Association, Bethesda, MD

Devra G. Kleiman, Mark Stanley Price, and Benjamin Beck, The Role of Zoos in Global Conservation, in Proceedings of 6th World Conference on Breeding Endangered Species, (1992), Am. Zoo and Aquarium Assoc., Bethesda, MD.

RIVER OTTER & FISHER REINTRODUCTION in Pennsylvania

Thomas L. Serfass, School of Forest Resources, Forest Resources Laboratory,
The Pennsylvania State University, University Park, PA 16802
814-863-3577

When European settlers first arrived in Pennsylvania, river otters (Lutra canadensis) and fishers (Martes pennanti) occurred throughout Pennsylvania. Extensive wetlands along the lower Delaware River and the complex networks of lakes, ponds, marshes, and connecting streams in northeastern and northwestern Pennsylvania supported the state's largest otter populations. Riverine habitats elsewhere in the state supported smaller otter populations. Fisher populations were widely distributed and well established in the old-growth forest that dominated the Pennsylvania's landscape.

Unfortunately, by the early 1900's, the combination of habitat loss and unregulated harvest had caused otter and fisher populations to suffer severe declines throughout the Commonwealth. By the mid-1950's, otter populations had become limited to northeastern Pennsylvania (primarily Wayne, Pike, and Monroe Counties) and the state's fisher population was extirpated. Otters are currently classified as a species "At Risk" and fishers as "Endangered/Extirpated" in Pennsylvania.

Implementation of modern wildlife and habitat management programs have improved conditions and resulted in renewed potential for otters and fishers to be reestablished to portions of their former ranges. To facilitate reestablishment of otter and fisher populations, I implemented the Pennsylvania River Otter Reintroduction Project (PRORP) in 1982 and the Pennsylvania Fisher Reintroduction Project (PFRP) in 1994.

During the otter project, I developed and refined a reintroduction strategy that consisted of six key components: 1) selection of appropriate release sites; 2) location of animals for release; 3) determination of appropriate numbers of animals to be released; 4) veterinary care; 5) public relations and education; and, 6) evaluation of the project's success. I followed a similar strategy during PFRP. Herein, I briefly review the components of the approach used to reintroduce otters and fishers in Pennsylvania.

Site Selection

A reintroduction project is doomed to fail if the release area does not contain appropriate habitat to sustain a population of the reintroduced species. Like most predators, otters and fishers maintain large home ranges and low population densities and, consequently, they require extensive areas of suitable habitat to establish and maintain a self-sustaining population.

Areas selected as otter reintroduction sites had unpolluted water, undisturbed riparian habitats, and abundant otter prey (i.e., forage fish and crayfish). Sites selected for fisher reintroductions were composed of continuous stands of mature timber, preferably with a high component of coniferous trees, and had abundant fisher prey such as small mammals, squirrels, and porcupines. Public lands were considered an essential component of reintroduction sites because the long-term integrity of habitats in these areas would not be threatened by development.

Since the inception of PRORP, 93 otters have been reintroduced into Kettle, Pine, and Loyalsock Creeks in northcentral Pennsylvania, Tionesta Creek in northwestern Pennsylvania, and Youghiogheny River in southwestern Pennsylvania. The largest continuous land area identified as comprising suitable fisher habitat occurred on State Forests in northcentral Pennsylvania. To date, 91 fishers have been released at 4 distinct sites in northcentral Pennsylvania: the southern Sproul State Forest Lands near the town of Renovo; the Quehanna Wild Area, mostly within the Moshannon State Forest, north of Clearfield; the area adjoining the Tioga and Tiadaghton State Forests in the Pine Creek Valley; and State Game lands in Sullivan and Wyoming Counties.

Source of animals

Ideally, sources of animals for reintroduction projects should be obtained from a large, nearby population that has evolved under environmental conditions similar to those that will be encountered at release sites. This increases the likelihood that reintroduced animals can survive and establish populations.

Although some otters successfully reintroduced in Pennsylvania were from Louisiana, most were live-trapped from the remnant population in northeastern Pennsylvania or surrounding states- New York and Maryland. Fishers reintroduced in Pennsylvania were purchased from trappers in New Hampshire and New York. Protocols on trapping and transporting otters from and fishers were subject to ongoing refinement and resulted in procurement of large numbers of healthy animals for release in Pennsylvania.

Numbers of animals

Reintroduction programs need to incorporate the concept of a minimum viable population when considering the number of animals needed to be released. The concept of a minimum viable population addresses issues pertaining to small populations such as inbreeding and chance occurrences such as poor reproductive years or changes in sex ratios. These issues are generally not a concern for large populations. However, in a small, reintroduced population, a series of poor reproductive years or several years that produce primarily male offspring could doom the population.

To maximize the chance of a successful reintroduction, PRORP and PFRP attempt to release at least 20 to 30 animals at each reintroduction site. In addition, release sites are positioned to enhance opportunity for eventual interaction among reintroduced populations and thereby offset potential problems sometimes encountered by small, isolated populations.

Veterinary Care

Cost and logistics limit opportunities to repeat failed attempts at reintroducing an animal. To maximize the chances for a successful reintroduction project, project managers should do everything possible to ensure that reintroduced animals are in excellent health and physical condition at the time of release. To be certain otters and fishers released in Pennsylvania were in top physical condition, each animal underwent a comprehensive veterinary evaluation during a period of captivity for 10 to 14 days. Any injuries or evidence of disease were treated during the captive period. Otters and fishers released in Pennsylvania typically gained weight while captive and were in excellent condition when released.

Public relations

Public support is critical for both initial and long-term success of wildlife management projects. A supportive public is less likely to tolerate illegal killing of reintroduced wildlife or to oppose the project.

Prior to initiating PRORP and PFRP, I informed the public about the projects through news releases and slide shows to interested groups. Public relations programs focused on describing natural history of the fisher and objectives of the reintroduction project. Overall, the public relations programs have been successful and the projects have been strongly supported by the public.

Evaluation and monitoring

Monitoring initial and long-term progress of reintroduced populations is critical in determining if a reintroduction project has been successful. Understanding fates of reintroduced populations allows project managers to modify courses of action to enhance the reintroduction process and to direct planning for future management of the species.

To evaluate the initial success of otters and fishers, several individuals at initial release sites were equipped with radio-transmitters to evaluate survival and movements. Long-term evaluations include surveys for tracks and scats in release areas. Otters are known to have survived and persisted at reintroduction sites in northcentral Pennsylvania since 1982 and have undoubtedly established self-sustaining populations. Results of otter reintroductions along Tionesta Creek and Youghiogheny River since 1990 are encouraging, but the time since releases occurred is insufficient to conclude that the reintroductions are a success. The fisher project is still in progress, but aspects of radio-tracking are encouraging and suggest fishers populations may establish in Pennsylvania.

Undoubtedly, PRORP has been successful in restoring extirpated river otter populations to portions of Pennsylvania. Although too early in the project to be certain, I'm optimistic that PFRP will also succeed in restoring fishers to northcentral Pennsylvania.

Acknowledgements: Funds and support for PRORP and PFRP were provided by the Pennsylvania Game Commission (PGC), the Pennsylvania Wild Resource Conservation Fund (WRCF; nongame tax-checkoff), the Allegheny National Forest, Pennsylvania Trapper's Association, Safari Club International (SCI), and local chapters of the National Audubon Society. PFRP has been supported by funds from PGC, WRCF, and The Center for Rural Pennsylvania.

Cross reference to Eastern Old Growth Forests, The Realities of Timber Harvesting.

THE FRENCH CREEK PROJECT:
The Public Education Approach to Watershed Protection

Brian Hill, Box 172, 590 N. Main, Allegheny College, Meadville, PA 16335
814-332-1946/-333-8149(fax)

Few streams in Pennsylvania are more attractive and diverse than French Creek. This nationally renowned waterway begins in Chatauqua County, NY, and flows for 117 miles through the northwestern Pennsylvania counties of Erie, Crawford, Mercer and Venango until it meets the Allegheny River, in Franklin, PA. The watershed encompasses approximately 1270 square miles, of which 1200 are in PA. With its outstanding water quality, rich biotic diversity, and notable historical background, French Creek is one of the most important streams in Pennsylvania.

Natural History of French Creek

The bountiful human history of French Creek and its watershed is matched by its diverse natural history. The physical and biotic significance encompasses organisms that have inhabited the stream since the glaciers of the last ice age pulled back some 10,000 years ago. Biologists have confirmed that much of the original flora and fauna native to the Creek is still thriving in portions of the stream. In fact, for example, over seventy species of fish live in French Creek - more than in any other stream in Pennsylvania.

Examples of the natural diversity can also be found in another group of animals dependent on a high quality water environment: freshwater mussels. 65 species of mussels have lived in Pennsylvania, and French Creek is still home to almost half of these species.

Mussels, being sedentary by nature, remain buried underwater in the sand and gravel of the stream bottom. Thus they are highly susceptible to effects of declining water quality. Such degradation in some stream segments has impacted these fragile organisms.

The same water pollution conditions have affected another group of organisms known as darters. No other tributary of the Allegheny has such a rich diversity of these small fish as French Creek.

Of the twenty five species of mussels that inhabit French Creek, two, the northern riffleshell and the clubshell, have been classified as endangered by the US Fish and Wildlife Service. These species have lost 95% of their historic ranges. The riffleshell is now found in only six streams in four states.

Mussels feed on debris ("detritus") and absorb dissolved oxygen from water drawn in and released by a tubular siphon system. Thus they are totally dependent on clean, high-quality water. They cannot relocate if their habitat is threatened. The larvae of mussels ("glochiidia") attach themselves to host fishes in order to obtain nutrients and move upstream to new riffles. When water quality decreases, fish populations decrease, and mussels in turn cannot survive.

Native Darter, up to 5 inches long

Darters, related to yellow perch and the walleye, exist in 14 different species in French Creek. These insectiverous fish are non-migratory, and are being threatened especially by degraded water conditions in the upper reaches of the Creek in Chatauqua County, NY. Two of the species, the eastern sand darter and the spotted darter, are endangered on the Federal or State levels. The eastern sand darter was thought to be extinct for 10 years until found in French Creek.

Water Pollution Sources and Control Techniques

Water pollution originates in either point or non-point sources. Point sources are places that can be located or pointed to on a map. Some examples are outfalls from sewage treatment plants or factories. Such discharges are regulated by the Clean Streams Law. Non-point-source pollution comes from places too large to be indicated with a single point, such as runoff from parking lots, city streets or farms. Such sources are difficult even to identify, much less to regulate. But French Creek and its rich biodiversity are threatened by both types of pollution.

Point source pollution is usually associated with urban areas, such as Meadville, Cambridge Springs, Saegertown and Fort LeBoeuf. The most important point sources of pollution for French Creek are associated with failing sewage treatment plants. Act 537, the Pennsylvania statute that regulates sewage treatment plants, has done much to help upgrade existing plants, but they are still releasing vast amounts of untreated or partly treated waste into the Creek. Citizens of the area can help by writing letters and encouraging city and township officials to improve these failing systems. Another way that ordinary citizens can help control the amount of point source pollution is to control the way harmful chemicals are discarded. (Do not pour things like oil or other harmful substances down drains, because these materials eventually reach the Creek).

Non-point-sources are difficult to quantify and control. One way to do so is for farmers and others living in the watershed to become aware of how their activities affect water quality. Non-point- sources can be controlled if local citizens and landowners become interested and active in the conservation effort.

Already in the watershed, the Natural Resources Conservation Service provides free planning for farmers. If a farmer wishes to regulate the amount of pollution entering French Creek or its tributaries from his farm, but does not know what steps to take, the NRCS will show him where to start. There are three major things a farmer should be aware of: feedlot placement, fertilizer, and pesticides.

Simply moving feedlots and grazing lands away from waterways, or maintaining a vegetated buffer zone along the Creek can vastly reduce the amount of pollution entering the Creek. Chapter 102 of the Clean Streams Law calls for no sediment (erosion from feedlots or fields) to enter the Commonwealth's waters. The Law often relies on voluntary compliance of landowners working with county conservation districts to eliminate pollution problems. However, blatant disregard of environmental laws can lead to more stringent sanctions by the Commonwealth.

Another non-point source of pollution is excess nutrients like nitrogen and phosphorous in the soil. These are important nutrients for plant growth. Some farmers use manure as well as chemical fertilizers on their fields. This can lead to excess fertilization, because once a plant has absorbed all the nutrients it needs to grow, the excess is left in the soil. This excess would then run off into the waterway when it rains. The plants that normally grow in the waterway would then be exposed to abnormally high levels of these nutrients, and their growth accelerated, choking the waterways, changing the natural habitat and forcing some native animal species to decline.

Many Conservation Districts have hired or are looking for Nutrient Management Technicians to help farmers assess soil conditions. After the farmers use manure to fertilize their cropland, the technicians analyze soil samples. This information is given to the farmers, so that they can apply only the minimum necessary synthetic fertilizer for proper plant growth, both saving money for the farmers and preventing runoff of the excess into French Creek.

Pesticides are also a major source of non-point-source pollution. Some farmers use them year after year, when in many cases they do not need them. If the pests have relocated or have not recovered in numbers since the last application of pesticide, farmers may be using more chemicals than they need. By employing integrated pest management (IPM), farmers can save money as well as help protect the environment.

IPM involves using pesticides only when they are needed and only in appropriate quantities. Also, by relying on some natural enemies of or deterrents to pests, farmers may spend less money than if they relied on larger quantities of expensive chemicals.

Conservation districts will work with farmers who are willing to try new techniques. This includes cost sharing programs so that farmers can afford to make the changes necessary to help the environment.

Threats to French Creek's Biodiversity

The threats to mussels, darters and other organisms stem from human interactions with the environment at all levels of our culture, from the individual to the governmental. Water running off roads can wash oils, salt and other chemicals into the stream, changing water chemistry. Sewage spills from faulty home septic systems, along with leaks and overflows from municipal sewage treatment plants, introduce nitrates, fecal matter and excessive levels of chlorine into the stream. Farm operations that do not use best management practices can cause runoff of fertilizers and animal wastes that enter the stream, stimulate algal blooms, and lead to an oxygen depletion that suffocates aquatic organisms. Pesticides that are applied too close to or directly on the stream can kill aquatic invertebrates and bioaccumulate in the food chain. Cows and other animals that are allowed to walk in the stream can cause increased sedimentation and streambed erosion, or spread hoof diseases to downstream herds. All of these factors have already combined to reduce the rich biodiversity that is characteristic of the Creek.

The Future of the French Creek Watershed

Despite the fact that water pollution does affect some portions of the stream, many parts of French Creek are still sufficiently clean to support healthy populations of game fish such as trout and bass. Because much of the watershed remains relatively pristine, it is possible to protect the remaining unpolluted portions of the stream and help to restore sections that have been degraded.

The Pennsylvania Environmental Council, the Western Pennsylvania Conservancy, and the Conneaut Lake and French Creek Valley Conservancy are strongly committed to protecting French Creek and its environs. Through research, analysis of water samples, and the monitoring of the Creek and its tributaries, these organizations are learning more about the stream's water quality, unique species, and natural history. In cooperation with Allegheny College, these organizations have initiated The French Creek

Project for public education and research. Based at Allegheny College, the Project recognizes that it is impossible to buy such a large watershed in toto and that for preservation to occur, there will have to be a large measure of public cooperation. The first goal of the Project is to raise public awareness of the value of the watershed through an aggressive education program. Of particular importance are riparian landowners, school teachers and students, and local government officials. The second goal is to serve as a catalyst for the development of a watershed organization composed of local people who are committed to protecting and enhancing stream water quality. Both of these goals support the overriding Project goal which is to conserve habitat, maintain biological diversity, and protect the endangered species in the stream.

The Project Advisory Committee includes a diverse mixture of points of view. Conservation groups such as the PA Federation of Sportsmen's Clubs and local conservation districts, plant managers for PPG Corporation, Lord Corporation, Dad's Products and Troyer Farms, local farmers and representatives of landowners association and property-rights groups all serve on the Committee. Members of the Committee are certain that water quality can be improved and habitat enhanced through a cooperative program that takes into account economic and human needs.

The Project is funded through the Western Pennsylvania Watershed Protection Program. This special program of the Audubon Society of Western PA is funded by the Howard Heinz Endowment. The Project also received a grant from the PA Dept. of Environmental Protection's Non-Point Source Pollution Program. And a number of local corporations have also pledged their support. The Project is a model for other organizations across the country for watershed protection.

FRENCH
CREEK
PROJECT

References:

White, L. R. and J. R. Stauffer, Jr., (1992) French Creek: A Fragile Aquatic Refuge, Penn State School of Forest Resources Annual Report, 8:2-7

US Dept of the Interior, Fish and Wildlife Service. US Endangered Species Act: Candidate Description - Northern Riffleshell Mussel.

USDI, Fish and Wildlife Service, (1993) Notification of Publication of Final Rule

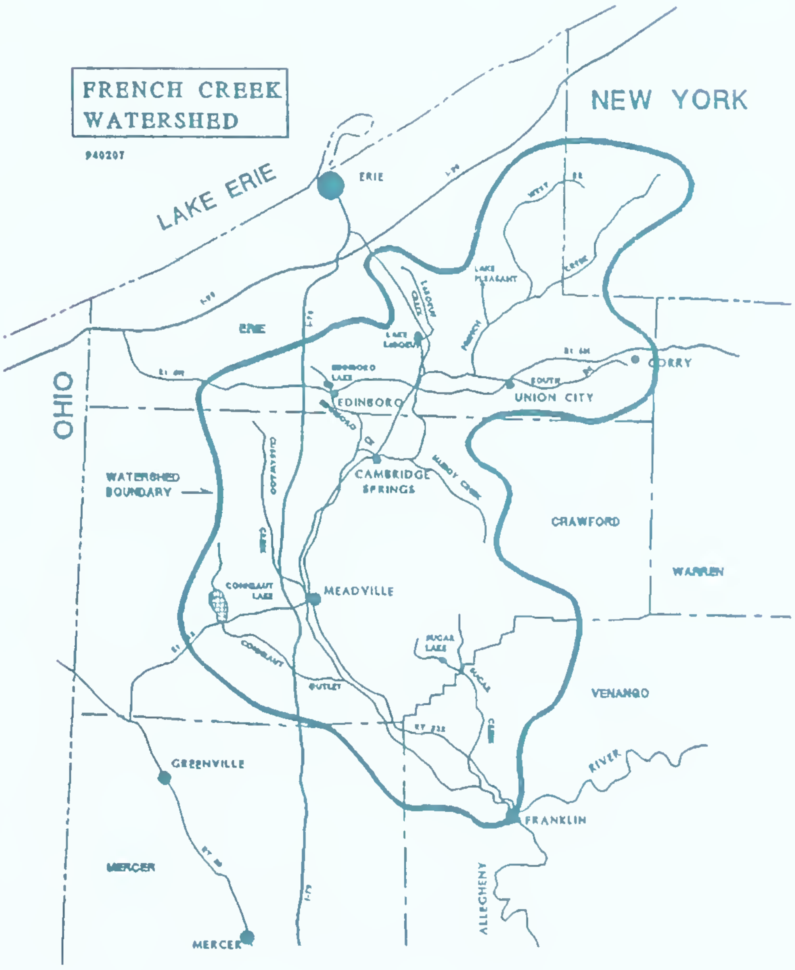
For further information, consult the following:

French Creek Project
Brian Hill, Director
PO Box 172, 590 North Main Street
Allegheny College
Meadville, PA 16335
814-332-2946

W. PA Conservancy
209 Fourth Avenue
Pittsburgh, PA 15222
412-288-2777

Conneaut Lake and French Creek Valley Conservancy
814-683-5364

PA Environmental Council
239 Fourth Avenue
Pittsburgh, PA 15222
412-471-1770



BLUEBIRDS - A Success Story

Nick Kerlin, Park Manager, World's End State Park,
Box 62, PA Rt. 154, Forksville, PA
18616-0062 717-924-3287

Population decreases of the Eastern Bluebird (Sialia sialis) began at the end of the nineteenth century, as a result of habitat loss due to changing agricultural and forestry practices. Introduction of and the resulting competition with the cavity-nesting House Sparrow and the European Starling also added to the problem. Bluebirds, once a common species of farmland and open country, were becoming harder to find. Some observers at the time even speculated that the species was on the road to extinction. By the 1940's erection of nest boxes began to slowly reverse that trend.

The purpose of the PA Bureau of State Parks' bluebird program is threefold: to increase the population of Eastern Bluebirds in the Pennsylvania State Parks; to provide information and assistance to park staff and the public on the program; and to act as a data collection bank and dissemination system for the information gathered.

Formal initiation of the program began in 1981 when 11 state parks erected 337 nest boxes that fledged 96 bluebirds. By 1995 the effort had grown to include 50 parks with over 1700 nest boxes that fledged nearly 2000 bluebirds. During the 15 years of formal program operation, over 20,000 bluebirds have been fledged through the efforts of 150 park staff and volunteers involved on an annual basis. Data collected are supplied annually to the North American Bluebird Society, Cornell University Laboratory of Ornithology and the Pennsylvania Game Commission. Information on the bluebird project is part of the on-going environmental education programs at nearly all state parks.

Further information can be obtained from the following:

1. PA Department of Conservation
   and Natural Resources
   Bureau of State Parks
   Environmental Education and
   Information Division
   PO Box 8551
   Harrisburg, PA 17105-8551
   1-800-63PARKS
   (information, nest box plans)

2. Cavity Nesting Program
   PA Game Commission
   2001 Elmerton Ave.
   Harrisburg, PA 17110-9797
   (information, nest box plans)

3. North American Bluebird Society
   Box 6295
   Silver Spring, MD 20916-6295
   301-384-2798
   (magazine SIALIA, books, information)

4. Laboratory of Ornithology
   Cornell University
   159 Sapsucker Woods Road
   Ithaca, NY 14850
   (information, research)

5. Ohio Bluebird Society
   20680 Township Road 120
   Senacaville, OH 43780
   (information)

6. Ohio Dept. of Natural Resources
   Division of Wildlife/Information Section
   1840 Belher Drive
   Columbus, OH 43224
   (information)

7. Bluebird Recovery Program
   Audubon Chapter of Minneapolis
   PO Box 3801
   Minneapolis, MN 55403
   (information, nest box plans)

Building Your Bluebird Box

TIPS

Construction

Dimensions shown are for boards 3/4" thick.

Use 1-3/4" galvanized siding nails or aluminum nails.

Pivot nails must be located exactly opposite each other as shown for proper opening of side board.

Allow 1/2" ventilation space between sides and top.

Cut 3/8" off each corner of bottom as shown.

Insert top and bottom board so that grain of the wood runs from front to rear of box.

Box Placement

Place boxes in open rural country with scattered trees and low or sparse ground cover. Avoid bushy and wooded area.

Avoid areas where pesticides are used or where house sparrows are abundant.

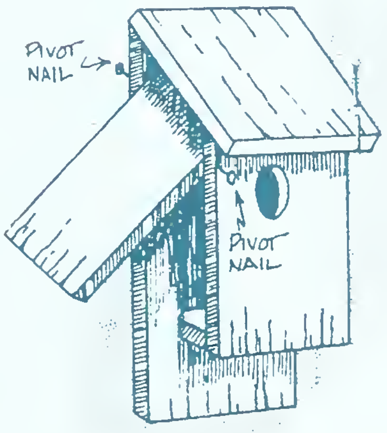
Mount boxes on poles or posts, with box bottom 3 to 5 feet from ground.

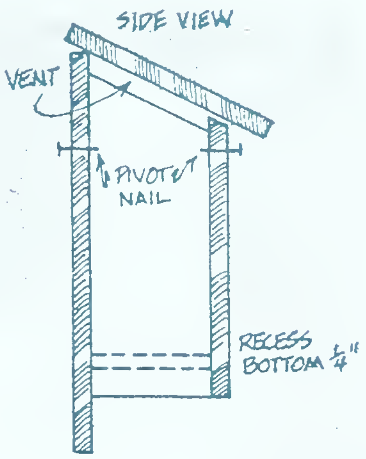
If possible face box opening away from prevailing wind and toward a tree 25 to 100 feet distant.

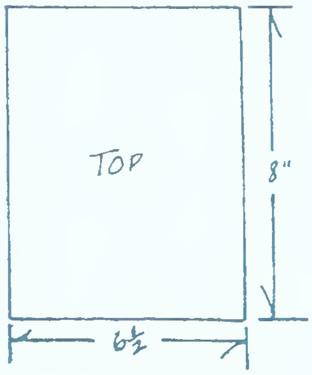
If possible locate boxes in afternoon shade.

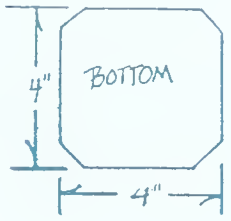
Keep boxes at least 100 feet apart.

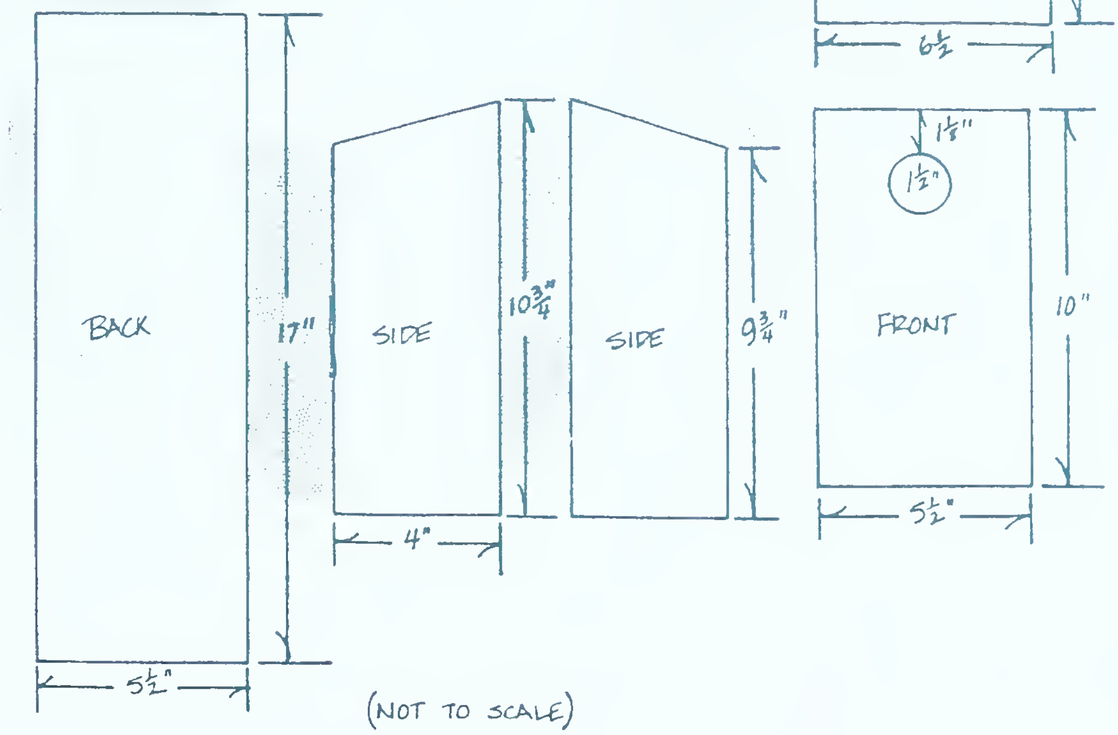
Erect predator guards if necessary.











(NOT TO SCALE)

OSPREY RESTORATION at Moraine State Park: Involving the Community in the Restoration Process

Chuck Tague, Naturalist/Editor, Nature Observer News,
432 Olympia Road, Pittsburgh, PA 15211
412-488-8760/-1364(fax)

August 23, 1993. Standing on the knob overlooking the lake, I had a clear view of not only the water, but the wooded hillsides, the grassy picnic area and a cloudless sky. A number of boats were on the water, mostly flat boats on big aluminum pontoons, and I could see traffic moving along the road on the far shore. I remember thinking that the park was pretty busy for a Wednesday afternoon in late August, but I felt alone, uneasy, very empty. Something important was missing.

This reaction was just the opposite to what I should have felt. I was standing in the Osprey hacking area at Moraine State Park. The birds were gone. The area was deserted, not only by the birds, but by the staff and volunteers who had worked all summer to ensure the survival of the young birds of prey. One or two of my co-workers were out in boats, in a futile search for any birds that may still have been in the area, but the hack site was still and quiet.

In early July, six young osprey were taken from their nests around the Patuxent River area of the Chesapeaker Bay. The Osprey population there is healthy and has been growing steadily since the ban on DDT. The birds taken were all between four and a half and six weeks old, and were the youngest from nests that had three or more nestlings. These birds had only a marginal chance of surviving in their original nests.

They were flown to Butler County, Pennsylvania, as a part of a reintroduction program initiated by members of the Moraine Preservation Fund. Here they were examined, banded and placed in compartments in a hacking tower overlooking Lake Arthur. Hacking is a process developed by falconers to prepare captive birds for a life in the wild. It has become a valuable tool in the efforts to reintroduce birds to places where they have been eliminated by the effect of pesticides. For example, most of the Peregrine Falcons that breed in North America today are here because of elaborate captive breeding and hacking programs.

Volunteers recruited by the Moraine Preservation Fund, a support group for the State parks in Butler and Lawrence Counties, received instruction on hacking procedures from Dr. Larry Rymon of East Stroudsburg University. Dr. Rymon pioneered Osprey reintroduction in the 1980's. A healthy breeding population of Osprey inhabits northeastern Pennsylvania because of his efforts.

The volunteers and state park employees fed fresh fish to the young Osprey, first in small pieces as their parent birds would present it, then whole fish so that the nestlings would learn to tear apart their prey. When they were strong enough, the enclosure gates were opened and the birds were free to fly. While they were developing their flying and diving skills, fish were provided on the tower and the birds would return to eat. As the young birds learned to fish, they became less and less dependent on the food we provided, until first one, then the whole group did not return at all.

Five of the Osprey had successfully fledged, but one bird tried to fly before it was ready. During its first night away from the nest it was unable to escape from a predator, probably a raccoon.

The other five grew strong and were soon catching fish on their own. They gradually dispersed to other waters in Western Pennsylvania, and in early September they began a journey that would last almost two years and take them thousands of miles away.

The young Osprey that were born along the Chesapeake and raised in Western Pennsylvania joined the great migration of hawks, falcons and eagles that move south along the mountain ridges and coast lines of Eastern North America. Their journey took them to the American tropics. But the next spring they did not return. They remained behind, honing their skills in the shallow coastal waters, mangrove swamps, wide rivers and flooded forests of South and Central America.

Our job was finished. The birds had successfully left the area. Now it was up to them. The true success of the project would only be told if, on a cold damp day in April, 1996, a pair of Osprey returns to roost on the poles on the slope in front of where I stood, the place they had known as home when they first left the security of the nest.

For millions of years Osprey have roamed the earth, fishing the lakes, rivers and estuaries, hovering over the shallows, plunging into the water to capture their prey. One of the widest-ranging land animals, they thrive on every continent except Antarctica. Before the first European settlers crossed the Allegheny Mountains, the rivers, streams and rich flood plains of the Upper Ohio Basin provided the ideal breeding habitat for these magnificent birds of prey. Subsequent clearing of the forest, plus damming and channeling of the rivers, overall water degradation and persecution of all predators by hunters and farmers drastically altered this once ideal habitat, and Osprey no longer nested in Western Pennsylvania. Osprey had vanished locally long before pesticides threatened to eliminate them from all of North America.

Following the ban on pesticides, along with the partial regrowth of the forests, improved aquatic habitats and the addition of several manmade lakes and reservoirs, Western Pennsylvania could again have supported Osprey and their young. But the region was isolated from the rapidly recovering population of Osprey along the Atlantic coast. In 1993, the Moraine Preservation Fund began the reintroduction program in Moraine State Park, centered on one of those large manmade lakes. The goal of the program was to hack, or raise and release, 80 to 100 nestling Osprey over a five year period.

Volunteers recruited from the community did a large part of the fund raising, constructed the hacking tower, roosts and nest sites, and cared for the young birds. The expected outcome of the project is to reestablish a breeding population of Osprey in Western Pennsylvania that will link populations established by similar projects in Eastern Pennsylvania, New York, and West Virginia. It has also served to involve the community in an important and dynamic conservation project.

(September, 1966, Update: In the spring of 1966, one of the five Ospreys hacked at Moraine State Park returned to nest with an unbanded bird whose origins are unknown. Together they fledged three nestlings successfully. The cycle goes on!)

For more information, contact:

Moraine Preservation Fund
c/o Wesley Hamilton
114 N. Main Street
Zelienople, PA 16063
412-452-7776

Dr.Larry Rymon
Biology Department
East Stroudsburg University
East Stroudsburg, PA 18301

Wild Resources Conservation Fund
PO Box 8764
Harrisburg, PA 17105-8764
717-783-1639/-787-9067(fax)

Return From Forever, a video. Obtainable from the Wild Resource Conservation Fund (see above). This video is an excellent summary of the Osprey reintroduction program in Pennsylvania.

Brauning, Daniel W., ed. (1993) Atlas of Breeding Birds in Pennsylvania, University of Pittsburgh Press.

AMERICAN SHAD RESTORATION
in the Susquehanna River Watershed

Michael L. Hendricks, Unit Leader, Anadromous Fish Restoration Unit,
Pennsylvania Fish and Boat Commission
Benner Spring Fish Research Station, 1225 Shiloh Road
State College, PA 16801
(814) 355-4837/-8264 (fax)

The American shad had a little known but important role in the early history of the United States. It is said that General George Washington's troops subsisted on salted shad during that long cold Valley Forge winter in 1776. Similarly, the American shad has played a particularly important part in the history of the Susquehanna Valley. On the Susquehanna River, shad penetrated well into New York state on the North Branch and into the West Branch and Juniata Rivers as well. In 1881, there were some 40 permanent seine fisheries in the North Branch alone. During parts of the year, each of these operations would bring in 300 shad per haul and up to 10,000 shad per day. These fisheries were an integral part of the growing economy of central Pennsylvania.

In 1830, construction of canal dams began cutting off shad runs to the upper portion of the river. However, in years of high water or when ice breached the dams, shad still migrated to upstream spawning areas. The final blow to the Susquehanna shad fisheries was the construction of the four large hydro-dams (York Haven, Safe Harbor and Holtwood in Pennsylvania and Conowingo in Maryland) between 1904 and 1932. Two early fish ladders, built at Holtwood Dam, failed to pass shad. As a result, the other hydro-dams were not required to build fish passage devices, and shad were completely cut off from their ancestral spawning grounds.

Restoration

The initial effort in shad restoration began in 1866 with the formation of what is today the Pennsylvania Fish and Boat Commission. In fact shad restoration was the driving force behind the formation of the Commission. The failure of early attempts to provide for fish passage at Holtwood Dam prompted the Commission to accept "in lieu of" payments from the power companies until shad passage technologies could be developed. This provided for a certain amount of money to be paid each year by the power companies to the Commission in lieu of shad being able to migrate upstream.

Shad restoration efforts were renewed in the late 1950's when studies were initiated to determine the feasibility of passing shad over the four largest Susquehanna River dams. Other studies demonstrated that the water quality in the river was sufficiently high to support shad runs.

In 1976, the Susquehanna River Anadromous Fish Restoration Committee (SRAFRC) was formed to supervise and fund the restoration. SRAFRC members include state fishery agency representatives from Pennsylvania, NY, and Maryland, the US Fish and Wildlife Service, the Susquehanna River Basin Commission and the four hydro-dams. Funding for the restoration is provided by the operators of the three upstream dams.

The contribution of the operators of Conowingo Dam has been the construction and operation of a fish lift at Conowingo. Each year since 1972, they have trapped adult shad below the dam and transported them by truck to upstream spawning areas. This "trap and transport" of adults was the first real step in the restoration effort. The second step is hatchery production at the Pennsylvania Fish and Boat Commission's Van Dyke Research Station. Van Dyke, the world's first successful Americana Shad fish hatchery, produces 10 to 15 million 20 -day-old shad fry and up to 100,000 four-month-old fingerlings each year. Other restoration activities include monitoring the downriver migration of juveniles using nets and special fish finders that use hydroacoustic equipment. Special studies have included radio tagging of adults, the extent of turbine mortality, if any, and the experimental use of strobe lights to direct out-migrating juveniles around turbine intakes.

Achievements

Progress was slow at first, but since 1985 each new year the evidence is mounting that the restoration is working. American shad have been captured in the Conowingo Dam fish trap every year since 1972. Trap catches hovered around 100 fish per year during the 1970s. In 1981 catches began to increase, and in 1995 the catch soared to 61,650 shad. Annual estimates of the total number of shad in the Conowingo tailrace show similar trends.

Tetracycline marking of all hatchery-reared shad was initiated in 1985 (See Appendix B, below). Since then the great majority of the juveniles netted above Conowingo Dam have shown hatchery marks. Recent evidence has verified that those tiny 20-day-old Van Dyke hatchery shad are not only surviving the rigors of life in the predator-filled Juniata River, but they are also surviving passage through turbines followed by three to five years at sea. Moreover, they are returning to the Conowingo trap!

Analysis of shad otoliths (ear bones) collected at the trap has confirmed that since 1989, an estimated 60 to 90 percent of the adult shad caught at the trap originated at the Van Dyke hatchery.

Progress is being made with power companies as well. In 1991, Philadelphia Electric Company, owner of Conowingo Dam, built a new lift capable of lifting 750,000 adult shad over the dam each year. In 1993, owners of the three upstream dams agreed to build lifts for their facilities. The agreements call for fish passage at Holtwood and Safe Harbor dams by 1997 and at York Haven by 1999. These fish passage facilities will open up 210 miles of riverine habitat. By the turn of the century, shad will once again roam unhindered throughout most of their historical range.

Appendix A: Life History of the American Shad

The American shad is the largest member of the herring family. Adults commonly reach four to eight pounds. The Pennsylvania record is nine pounds, nine ounces. These beautiful silvery fish are prized by anglers for their sporting qualities. Shad are among the strongest and hardest fighting of freshwater fishes. Their flesh is considered excellent table fare, although it is bony. Shad roe dinners are an annual "rite of spring".

Like all anadromous fish, shad spend most of their life in the ocean and return to freshwater to spawn. Each spring adult shad migrate into coastal rivers from Florida to Newfoundland. Spawning takes place around dusk at water temperatures from 60 to 65 degrees F. A single female shad can produce up to 600,000 eggs, but most average around 250,000 eggs.

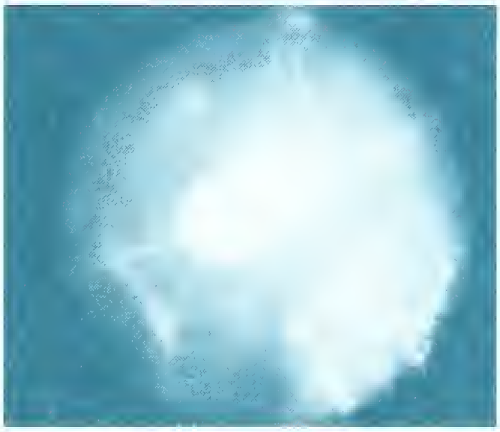
Spawning often occurs near the surface and is accompanied by noisy splashing as the eager males cavort with the roe-laden females. After fertilization, the eggs sink slowly to the bottom and lodge in the gravel where they remain until hatching takes place in five or six days. After hatching, the fry grow rapidly, feeding heavily on freshwater plankton and aquatic insects. The strong schooling instinct displayed by shad develops early, and by fall, large schools of four-tosix-inch juveniles can be seen dimpling the surface as they feed on evening hatches of aquatic insects.

Decreasing water temperatures and cool fall rains trigger a mass downriver migration. By December, the young-of-the-year shad have begun the first step of their vast ocean migration. Once in the open ocean, shad migrate up and down the coast, from their winter range off the mid- Atlantic to their summer range in the Bay of Fundy, off Nova Scotia. In the spring of their third or fourth year, male shad mature, depart from their northward spring migration , and seek their natal river (river where hatched) to repeat the spawning cycle. Females follow, maturing at four to five years of age. Unlike Pacific salmon, not all shad die after spawning. Some shad, particularly in northern rivers, do live to spawn again.

Appendix B: Tetracycline Marking

Evaluation of the success of the restoration effort hinged on development of a method to distinguish between hatchery-produced and wild shad. Because the majority of the hatchery-reared shad are stocked at 18 to 20 days of age, traditional devices, such as jaw or dart tags or fin clips, are unusable. Instead, a sophisticated system of marking using tetracycline antibiotics has been developed.

Shad fry, as young as three days of age, are immersed in a tetracylcline solution that is absorbed into growing bone tissue. At this early age, the otolith, or earstone, is the only true bone present in the fish. All other bones, still in their early stages of development, are comprised of cartilage. The otoliths grow by adding rings, similar to the rings in tree trunks, except that one ring is laid down each day. Because otolith rings begin to form at hatching, tetracycline immersion at three days produces a tetracycline mark in the third ring.



View of otolith cross-section in transmitted fluorescent illumination, showing tetracycline-labelled rings.

The tetracycline is detected by removing the otolith, grinding a thin section and viewing the otolith under a microscope using ultraviolet illumination,in which the tetracycline fluoresces yellow.

Additional immersion of the young shad at later dates produces multiple marks. Feed laced with tetracycline can be fed to fingerlings to produce still more marks. Unique combinations of immersion and feed marks can then be used to mark fish according to stocking site, the river from which eggs were obtained, and age at stocking (fry or fingerling).

Since 1985, every shad produced at Van Dyke hatchery has been marked with tetracycline. Analysis of these returns permits fine-tuning of the restoration effort, expanding those programs that are working or modifying those that are not working. The Pennsylvania Fish and Boat Commission has received national recognition for its leadership role in the development of this important new technology.

References for Susquehanna River American Shad Restoration Program

1. Michael L. Hendricks (Unit Leader) or R. Scott Carney (Fish Passage Coordinator). See paper title for address and phone.

2. Richard St. Pierre, Susquehanna River Coordinator
   US Fish and Wildlife Service
   1721 Front Street, Suite 105
   Harrisburg, PA 17102
   717-238-6425/-0495(fax)

3. Paul Swartz, Executive Director
   Susquehanna River Basin Commission
   1721 Front Street
   Harrisburg, PA 17102
   717-238-0422

4. Dale Weinrich, Fisheries Biologist
   Maryland Department of Natural Resources
   Matapeake Terminal
   Box 378, Rt. 8
   Stevensville, MD 21666
   410-643-6801/-4136(fax)

5. Rick Hazard
   Alliance for the Chesapeake Bay
   225 Pine Street
   Harrisburg, PA 17101
   717-236-8825/-9019(fax)

6. Jolene Chinchilli, PA Executive Director
   Chesapeake Bay Foundation
   214 State Street
   Harrisburg, PA 17101
   717-234-5550

7. Bill Goldsborough, Sr. Fisheries Scientist
   Chesapeake Bay Foundation
   162 Prince George Street
   Annapolis, Md 21401
   410-268-8816

BIOLOGICAL CONTROL of PURPLE LOOSESTRIFE in Pennsylvania

Bradley J. Gochnauer, Landstudies Inc., PO Box 97, 59 South Third Street, Oxford, PA 19363
610-932-3762/-2854(fax)

Purple loosestrife is an aquatic perennial plant that was introduced from Eurasia into North America in the 1800's. The arrival and spread of purple loosestrife in the United States has been a combination of accidental and intentional introductions. It was present along eastern seaports in the 1830's when ships from Eurasia dumped seed-contaminated ballast. Purple loosestrife spreads via canals, rivers and streams. Its beauty, vigor, and long blooming season made it an ornamental favorite. The plant was also propagated for its medicinal qualities and as forage for bees. In Pennsylvania, it is known to occur in 45 of our 67 counties. It is present in all the major watersheds of Pennsylvania, but the greatest density occurs in eastern Pennsylvania along the Delaware River and its drainage area.

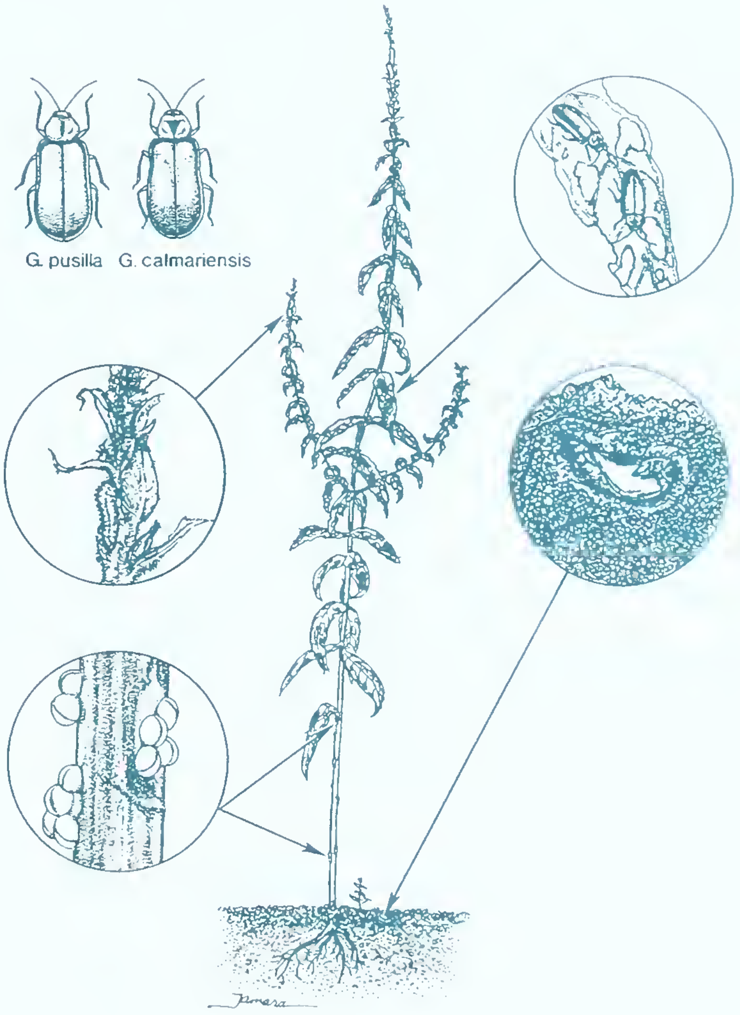
Purple loosestrife prefers moist organic soils and full sun, although it can survive and multiply in many soil types and moisture conditions. Purple loosestrife is a perennial plant that sends up numerous flowering stems year after year. In one year, a single mature plant can produce over a million seeds that generally have a high germination rate. New loosestrife plants can also grow from small pieces of broken or mowed plants that root in moist soil and from roots that send up new shoots. The beautiful magenta blossoms of the purple loosestrife mask its destructive power. Purple loosestrife is choking out our commonwealth's wetlands. It grows in dense stands, crowding out native vegetation that wildlife use for food and shelter. It can form dense, impenetrable barriers between land and water that not only exclude waterfowl, but even people trying to gain access for fishing or boating. The matlike root system and foliage of dense stands reduce the natural flow of waterways, promoting the deposition of silt, causing long-term water quality degradation.

In the fall of 1993 a coalition was formed to combat this destructive invader. The coalition included the Pennsylvania Departments of Agriculture and Environmental Protection, the Pennsylvania Game Commission, the Pennsylvania Wild Resource Conservation Fund, Waterfowl USA-Lancaster County Chapter, and Landstudies, Inc. Environmental Consulting. A program of biological control was selected to most effectively manage this invasive species.

The Galerucella spp. beetle was selected as the biological control agent for purple loosestrife. This beetle originated from Eurasia and is propagated at Cornell University in Ithaca, NY. the beetles feed exclusively on purple loosestrife and require this plant to complete their life cycle. The beetle was released at four sites in Pennsylvania: Marsh Creek State Park, Haldeman Island, Safe Harbor Island, and Presque Isle State Park. The beetles were released into the stands of loosestrife in early June, 1995. The biological control program includes the initial release of beetles, a monitoring program, and beetle propagation for the following year. Approximately 1000 beetles were propagated by Landstudies, Inc and released at the four sites in the fall of 1995. Monitoring of the four sites will continue in 1996 to assess the success of the beetles.

Because of the large population of purple loosestrife in Pennsylvania and its aggressive adaptability, the invasive plant will not be totally eradicated by the introduced beetles. The goal of this project is to reduce weed densities so that the impact of the loosestrife is limited in Pennsylvania's wetlands.

Adult *Galerucella pusilla* and *G. calmariensis* and the feeding sites of mature and immature stages.



Below is a list of national contacts for biological control of purple loosestrife, as well as for the program being conducted in Pennsylvania.

National Contacts

1. Dr. Bernard Blossey
   NY Cooperative Fish and
   Wildlife Research Unit
   Department of Natural Resources
   Fernow Hall, Cornell University
   Ithaca, NY 14853
   607-255-2839/-1895(fax)

2. Stephen Hight
   University of Maryland
   Department of Entomology
   1300 Emmons Hall
   College Park, MD 20742
   301-405-3944

3. Luke Skinner
   Minnesota Department of Natural Resources
   500 Lafayette Road
   St. Paul, MN 55155
   612-296-2835/-1811(fax)

Pennsylvania Contacts

1. Bradley J. Gochnauer
   (see paper title for address)

2. Will Mountain
   PA Department of Agriculture
   Bureau of Plant Industry
   2301 North Cameron Street
   Harrisburg, PA 17110-9408
   717-787-9408/-783-3275(fax)

EASTERN OLD GROWTH FORESTS

Sam Hays, Environmental Historian, University of Pittsburgh
1421 Wightman Street, Pittsburgh, PA 15217
412-421-6560 e-mail: sph1+@pitt.edu

Most of us know about old growth forests through the debate over the ancient forests in the Pacific Northwest. But in recent years both ecologists and the public have become interested in eastern old growth. Three eastern old growth conferences have been held over the past three years, one in 1993 in Asheville, NC, the second at Williamstown, MA, in 1994, and the third in 1995 at Fayetteville, AK. Future conferences are planned. Perhaps one will take place in western Pennsylvania that will feature Cook Forest, one of the largest old-growth forests in this region.

This paper is a report on that interest. First, however, the place that old growth plays in this conference on ecological restoration should be established. For above all, the creation of old growth is a matter of forest restoration.

First off, it should be emphasized that old growth implies not just old trees, but but of old forest ecosystems. While some think of old growth simply as groups of trees that display a majestic quality just because they are big and old, in fact the more important emphasis should be on old forests that entail continuity over the years in the species, the interactive ecosystem and the soils - old ecosystems, not just old trees.

Second, old growth concerns not just species, but also habitats. Many plants and animals live in old growth forests, and many depend on those forests as the unique habitats to which they are attuned. The spotted owl received a great deal of publicity in connection with the ancient forests of the northwest, but there was much more of importance in that issue than the spotted owl alone. Thousands of species live in those old forests and over five hundred have been found to depend on them as habitat. While most of the presentations at this conference focus on the recovery of individual species, such as the osprey and the otter, the restoration of whole ecosystems is perhaps more fundamentally important. Old growth forests are such whole ecosystems.

Third, implicit in old growth activities in the East is the strategy of restoration as well as protection. There is no question about the need to protect existing old growth, and eastern citizens groups are exploring forests to find more to protect. But it is well to keep in mind that most old growth was eliminated long ago, which suggests the need for a policy of restoration. Old growth is an especially significant element of this conference on "restoration".

The old growth movement in the East is a combination of the interests of both scientists and the public, and the conferences held thus far bring together both groups to explore old growth. Scientists, for example, attempt to determine just how an old forest differs from a young one. They reconstruct historical conditions over the years to determine how forests have changed with cutting from the time of initial European settlement to the present; this establishes a bench mark to which forests can be restored. Research compares existing old forests with young ones, in terms of a wide range of forest conditions, such as song birds, salamanders, lichens, mosses and liverworts, as well as trees. All this, of course, is difficult because so little old growth exists, but there is enough in such places as the Adirondacks, the southern Appalachians, the Boundary Waters Canoe Area and the Upper Peninsula of Michigan to provide some areas for comparison with younger and more recently cut forests.

The public, on the other hand, helps to discover and popularize old growth. One result is the first-time-ever publication of an inventory of old-growth and a book on eastern old-growth, both edited by Mary Byrd Davis. Eastern old growth articles appear in the magazine, Wild Earth, published in Vermont. At the same time, some citizen groups scout forests to discover old growth areas not previously identified. A recent report to the Nantahala-Pisgah National Forest in western North Carolina by the Western North Carolina Alliance included over 200 newly discovered areas.

Amid all this, one of the perennial questions is: what are the characteristics of old forests? An understanding of the full complexity of an old forest can be approached at three different levels of description. The simplest and most common is that old forests contain much dead and down wood, many snags and decaying trees, and many logs on the ground in different stages of decay. Based on that understanding, one national forest plan includes beginning to monitor dead wood, both standing and down, so as to chart changes over the years, just as one might chart forest growth from saplings to poles to sawlogs. For eastern forests, it must also be emphasized that old growth is multilayered from the canopy to the ground level. This might be termed a description of the structural characteristics of old growth forests based upon the patterns of trees, but in a far more inclusive way than the common description which is confined to commercially valuable "green" trees.

A second level of description involves considering the elements of the forest as an ecosystem, that is, the plants and animals in and dependent on old growth. Some research in Pennsylvania, for example, concludes that old growth serves as a distinctive habitat for birds and especially neo- tropical songbirds. New England studies have done the same for lichens, mosses and liverworts. Others have compared salamanders and wildflowers in older and younger forests in the southern Appalachians. Almost all of this research has concluded that older forests, for the most part, are richer in species than younger forests. However, a more important conclusions is that for almost every forest element, selected species may be more abundant in older forests while others are more abundant in younger forests. If one is interested in species richness, this seems to suggest that a balance in habitats is important, requiring especially an increase in older forest habitats which are significantly underrepresented in eastern forests.

Still a third area of description, far less explored, is old forest soils. What is the difference between the soil organisms in older and younger forests? When soils are turned by plowing, such as was the case in New England when it was heavily farmed, what changes take place and how long does it take for the soil to recover its earlier, old forest composition? Some research has found that when soils are disturbed by clearcutting the biological composition of the soil changes from being dominated by fungi to being dominated by bacteria, with accompanying changes in mycorrhizae and forms of nitrogen. Thus, some scientists will argue that a major blow-down in an old forest area is quite different from a clearcut in its effect on the total ecosystem: while the effect of changes in the light distribution is similar in the two "disturbances", the soil suffers far less disruption from blow-down. The older soils remain despite the blow-down. If they are disturbed by harvesting machinery or preparation for re-planting, then a significant part of the old- growth forest is destroyed.

Several eastern management agencies are involved in the development of old growth policies, including those responsible for national and state forests, and for private conservancies. On the National Forests, a directive from the Chief of the US Forest Service in 1989 called for each forest to establish an old-growth policy. A survey of the eastern national forests indicates that most have made some steps towards establishment of such policies. The major difference between the policies has to do with their definitions of what is considered to be old-growth. In the southern states the definition is limited to old trees. As one moves north, other structural characteristics are added, including ecological features. In only one case is soil a part of the thinking on which old-growth policy is based.

State policies are more limited; at this point, apparently only two states, Minnesota and Michigan, have old-growth policies in place. The Pennsylvania forest plan mentions old-growth as an objective, but no action has yet appeared to implement that objective. There is some interest in old-growth in private conservancies, especially those in New England that have acquired land over the course of the 20th century and now have relatively old forests. Some conservancies feature their old forests and encourage their members to understand and appreciate their ecological characteristics. This is the case with the Massachusetts Audubon Society and the Society for the Protection of New Hampshire Forests. A number of more recently established conservancies, however, think of their forest land as candidates for old-growth over the years through a policy of protection from human disturbances.

The interest in eastern old growth reflects an important advance over years past when old forests were considered to be worthless. The dominant thought was to replace them with tree crops in relatively short 80-100 year rotations. At that time old forests were described as overmature rather than with terms that reflected an understanding that they were valuable simply as old forests. Such terms as "pathological" and "decadent" are still often used to describe older forests. For example, "pathological maturity" is used to imply that old-growth is merely a forest disease. Continued use of such terms suggests that these older ideas persist and that some still think old forests are really worthless.

The crucial initial management issue is whether or not the agency in charge values old growth for itself rather than considering it as an anomaly or a defect in a more dominant focus on short- rotation wood production. Beyond that issue is whether or not the management agency has a perspective in which restoration and not just protection is a major strategy. For just as we restore species such as ospreys and otters, we can also restore old growth. In the East a renewed focus on restoration is under way . As the old growth movement goes forward, the key element is whether or not national, state and private agencies work out a significant old growth forest restoration strategy.

For further information:

Davis, Mary Byrd, "Old Growth In The East: A Survey", The Cenozoic Society, Inc., PO Box 455, Richmond, VT, 05477, $20

Davis, Mary Byrd, Ed., (1996), "Eastern Old Growth Forests: Prospects for Rediscovery and Recovery", Island Press, Box 7, Dept. SNAA , Covelo, CA 95428, $19.95 paper.

Wild Earth, a quarterly published by the Cenozoic Society, at PO Box 455, Richmond, VT 05477, $25 per year.

"Nantahala-Pisgah Old Growth Survey: Citizen Involvement in Old Growth Protection", Western North Carolina Alliance, 70 Woodfin Place, #4C, Asheville, NC 28801. $10.

Hays, Sam, (1994). "Northeastern Old Growth Conference Report", 1421 Wightman Street, Pittsburgh, PA 15217. $2

WETLANDS RESTORATION:
Correcting the Past

Shayne Hoachlander, Land Mgmt. Supervisor, PA Game Commission, RD 2, Box 140, Corry, PA 16407, 814-432-3187

Bary Zafuto, Federal Aid Supervisor, PA Game Commission,m 120 Elderwood Drive, Ebensburg, PA 15931

Over 50% of the nation's wetlands have been destroyed since the arrival of Europeans. We now know that wetlands provide many benefits to wildlife and humans. To reverse the trends of wetland degradation a program called "Partners for Wildlife" was initiated in 1989. This program has developed partnerships for wetland restoration among government agencies (e.g., US Fish and Wildlife Service, Pa Game Commission, Natural Resource Conservation Service, Conservation Districts), private organizations (e.g., Ducks Unlimited, Waterfowl USA, Pheasants Forever), and most importantly, willing private landowners.

The program's focus is on restoring drained wetlands, particularly on private land. Sites are prioritized based on project size, proximity to other restoration sites and wetland complexes, funding sources, soils, topography, participation in the PA Game Commission's public access programs, and cost efficiency. The statewide average cost goal for US Fish and Wildlife Service funding is $500/acre restored, with $1000/acre the maximum permitted. Additional funding has been provided by other government agencies, private organizations and landowners. Participants must agree to maintain the restoration site for a minimum of 10 years. All permitting, engineering, technical design and administration are handled by government agencies to ease the process for the landowner. Participation requests currently exceed the capabilities of the agencies to meet the demand.

Wetlands are identified by three criteria: hydric soils, hydrophytic vegetation, and adequate wetland hydrology. Historically, wetland functions have been destroyed by altering the hydrology of the wetland. On farmland this was normally accomplished by using drain tile and ditches. Restoration begins by identifying the method and location of the drainage system. The system is then destroyed by crushing the tile, plugging the ditches, and constructing low dikes to restore the wetland hydrology.

Restoration sites are generally designed to maintain an average water depth of 18 inches. Control devices are occasionally installed in the dikes to permit better control of water levels. Also, inundated areas should provide a good interspersion of open water and emergent vegetation. This is achieved by varying the topography and soils of the underlying substrate. Ideally, 50-70% of the area should contain emergent vegetation. To insure successful vegetation of the restoration site, it is imperative to save the top soil during earth-moving operations and redistribute it to areas where vegetation is desired at the close of the construction phase. Open water can be maintained by excavating deep areas to prevent sunlight from penetrating the water to the substrate depth, thereby retarding emergent vegetation growth. To some degree, open water can be maintained in shallow water areas by insuring that these areas are devoid of top soil. This also retards vegetation growth by minimizing nutrients and suitable germination and rooting sites.

Normally, natural revegetation of the site begins quickly. Many sites contain adequate seedbanks of wetland plants from pre-drainage times. Also, many plant seeds are transported to the sites by wind and wildlife. Some of he first plants to recolonize the sites are spike rushes (Eleocharis spp.), common cattail (Typha latifolia), softstem bulrush (Scirpus validus), water purslane (Ludwigia palustris), water plantain (Alisma Plantago-aquatica), Pennsylvania smartweed (Polygonum pennsylvanicum), blue vervain (Verbena hastata), boneset (Eupatorium perfoliatum), and beggar's ticks (Bidens spp.). In some cases additional planting or seeding may be desired to accelerate revegetation, increase diversity, or meet specific aesthetic or wildlife needs. Native species are encouraged in these cases. Bur-reed (Sparganium americanum), buttonbush (Cephalanthus occidentalis), red-osier dogwood (Cornus sericea) and various species of arrowhead (Sagitarria spp.) are recommended when additional plantings are desired.

Generally when trees occupy the restoration site, some are retained in the inundated area to serve as snags. Snags serve as hunting and resting perches for many birds such as belted kingfishers (Megaceryle alcyon) and cedar waxwings (Bombicillia cedorum). Also downed logs and stumps are positioned to provide resting and basking areas for waterfowl, muskrats (Ondatra zibethica) and turtles. When possible, existing shrub areas are flooded. Flooding shrubs can provide immediate brood cover for young ducks. Young ducks cannot fly; thus their only means to escape avian predators is to swim into areas of dense brush which provide overhead cover. Occasionally, areas surrounding the restoration sites have been planted with native warm-season grasses to provide nesting habitat and cover for ground-nesting birds such as mallards (Anas platyrynchos) and blue-winged teal (Anas discors).

Ordinal scale surveys have been conducted to compare before- and after-restoration observations of wildlife by restoration site landowners. These surveys show increases in landowner observance of wetland-associated birds, mammals, amphibians and reptiles after the restoration.

Because this program only involves willing participants it has been very popular and extremely effective. Over 1800 acres of wetlands have been restored in Pennsylvania. Currently the status of this program is precarious. Congress, in its search for budget-cutting areas, has looked at eliminating this program. Its survival is dependent on public support. Encouraging Senators and Representatives to support the "Partners in Wildlife" program, administered by the US Fish and Wildlife Service in the US Department of the Interior is recommended. Also, wetland restoration work in the future may continue under a new "Wetland Reserve Program" administered cooperatively by the Natural Resources Conservation Service (NRCS) in the US Department of Agriculture and by the US Fish and Wildlife Service in the US Department of the Interior. We recommend supporting this program and encouraging Congress to permit the enrollment of lands that protect or enhance wetland values in the "Conservation Reserve Program", also administered by the NRCS.

In closing, wetland restoration under the current "Partners in Wildlife" program and the new "Wetland Reserve Program" is encouraging, effective, and positive. But efficiency would be better served if we would have protected these treasures to begin with. Lessons learned through hard experience should not be ignored.

For more information regarding the "Partners in Wildlife" program in Pennsylvania, contact Dennis Brown, US Fish and Wildlife Service, Suite 322, 515 S. Allen Street, State College, PA 16801 (814-234-4090).

For identification of wetland plants, consult:

Fassett, N. C., 1980. A Manual of Aquatic Plants, U. Wisconsin Press, Madison, WI

Hotchkiss, N. 1972. Common Marsh, Underwater and Floating-Leaved Plants of the United States and Canada, Dover Publications., Inc., NY

For endangered plant and animal status information, consult:

Rhoads, A. F. and W. M. Klein, Jr. 1933. The Vascular Flora of Pennsylvania Annotated Checklist and Atlas, The American Philosophical Society, Philadelphia, PA

The Realities of Timber Harvesting & Forest Stewardship from the Point of View of an Award-Winning Timber Company

Blaine A. Puller, Land Manager, and Ned Karger, District Manager, Kane Hardwoods,
(a Division of The Collins Pine Company), PO Box 807 Kane, PA 16735
814-837-6941/-8401(fax)

(Editor: This paper was invited because of the editor's concern that many conservationists are unaware of the existence of timber-products companies such as Collins Pine. With opinions so polarized, it is important to realize that there are companies with longstanding commitments to sustainable forestry, commitments which are lived out on the ground. Collins Pine is the first and only US company to undergo an intensive audit of their field and mill activities lasting more than a year, conducted by an international team, and be certified as a sustainable operation, both in their West Coast and their Pennsylvania operations.

I. Collins Pine Company and Pennsylvania Forest History

The Collins Pine Company dates back to 1855 when T. D. Collins began timber operations in Forest County, PA. The company remains a family-owned business and still manages lands purchased over 140 years ago. The company is now headquartered in Portland, OR, with mills and lands in Oregon, California and Pennsylvania. The PA Division (Kane Hardwood) operates a sawmill in Kane and manages 120,000 acres of land in seven northwest Pennsylvania counties.

The sole purpose of this land ownership is to grow and harvest trees on a sustainable basis. But we recognize that all of the land is not suitable for timber production, and that with land ownership comes stewardship responsibilities. All of the land is open to the public for non-motorized dispersed recreation. Over 43 miles of riparian corridors are protected and other special areas are designated where timber production is set aside for the protection of other ecological values.

To understand forest management practices in Pennsylvania's hardwood forests, one must understand the historical events that created the forests of today. Prior to European settlement, tornadoes, fire, insects and indigenous peoples affected the forest and cause constant changes in the forested ecosystems. As Europeans settled the continent, forests were cleared to provide land for agriculture, building material and fuel. Early timber harvesting was confined primarily to river and stream corridors because of the heavy reliance on water transportation. Later development of steam power and railroads opened virtually the entire forest for harvesting. The demand for wood products increased. Later the demand for chemicals (acetate, acetone, tannin) and charcoal for the iron industry led to even more harvesting.

By the early 1900's most of Pennsylvania's forests had been clearcut. This cutting was done to meet the demands of the time without almost no thought for the future. These conditions created the forest we have today. Forest renewal took place in spite of the mismanagement of the early harvesting, but conditions today are very different. Today's forests are maturing and whether harvested or not, change will continue to occur. It is a forester's job to protect forested ecosystems and their ability to renew so that they can continue to provide a multitude of products and ecological values.

Today 59% of the land in Pennsylvania is forested. 79% of this forestland is privately owned. Every ten years, the US Forest Service inventories all Pennsylvania forest lands. The latest data (1993) showed that the current ratio of growth to removals (harvesting + mortality) is 2.1 to 1.

But this is just part of the story. One of the major factors affecting the health and biodiversity of today's forests is the white-tailed deer.

II. White-Tailed Deer

White-tailed deer are preferential browsers which consume large quantities of woody stems, buds and leaves. Research has shown that high deer populations alter forests by reducing or eliminating tree seedlings, shrubs and other plants which are highly preferred. Heavy browsing can also reduce wildlife habitat, food, cover and nesting sites.

Deer populations in the virgin forests were relatively low prior to European settlement. In the 1700's and 1800's, deer hunting provided meat for the settlers and the markets of the cities along the east coast.With the high demand for meat and in the absence of game laws, the white-tailed deer was almost eliminated from Pennsylvania by the end of the 19th century.

As many of the second-growth forest stands of today were being established and starting to grow, the deer population was so low that it had virtually no effect on the new growth.

The first game laws in Pennsylvania were established in 1895, when all deer hunting was banned. With abundant food available in the sapling-sized forest, the prolific deer recovered to the point that a "bucks only" hunting season was established in 1921. Buck hunting has almost no effect on the overall deer population levels as a single buck can mate with many does. Many does will mate in their first season and most does will produce twins or triplets. Thus the deer populations continued to grow until the 1930's.

In the 1930's as the forest grew to the pole stage which produces less available deer food, severe winters led to widespread starvation, and it became apparent that the deer population was out of balance with their habitat. The PA Game Commission instituted a "doe" or antlerless season, but the deer population remained high through the 1980's. As the second-growth forest began to reach maturity and be harvested, it became evident that the forest would not regenerate naturally with such high deer populations. Areas that did regenerate contained fewer species (less diversity) than the previous stands because of preferential browsing. Heavy browsing was also having a negative effect on habitat for other species.

Deer enclosure research showed that most sites would regenerate to desirable species in the absence of deer browsing. Research was undertaken to determine optimum population levels which would allow for a healthy deer herd, healthy populations of other species and for the ability of the forest to regenerate. Deer enclosure studies researched the effects of various controlled deer populations on harvested and unharvested forest areas. The results of these studies showed that as deer populations decreased, the diversity and abundance of shrubs and tree seedlings increased. And as deer populations decreased, the diversity of song birds, wildflowers and other non-woody plants increased. These studies support reducing the deer populations to protect the biodiversity and long-term health of Pennsylvania's forest.

In the early 1980's the PA Game Commission set goals to reduce the deer herd and began to increase the number of antlerless licenses allocated to counties which had high deer populations. Some areas where hunting pressure was heavy experienced populations reductions. Other areas continued to have high populations and over-browsing problems.

Recently because of pressure from some sportsmens' groups the PGC has reduced the number of antlerless licenses even though the deer population is still estimated to be well above the goals. Environmentalists, foresters and all who care about the long-term health of forest ecosystems should support moving toward the PGC deer populations goals.

III. Forest Products

Wood products are only one of the many benefits that society gets from the forest. Other products such as recreation are also important. This is where most people interact with and form opinions on the forest. Hiking, backpacking, hunting, fishing, skiing, mountain-biking, All- terrain-vehicle riding, snowmobiling, sighthseeing and camping are just some of the activities which take place in forested landscapes.

Wildlife is another forest product. Viewing wildlife in a natural setting is important to most people's forest experiences. But wildlife is also important to long-term sustainability of forested ecosystems. Intricate relationships between animals and their habitats must be studied to truly understand what a forest ecosystem is all about.

Clean air and water are also products of a healthy forest which must be protected. Forests also produce food for humans, such as mushrooms, berries, fruits, nuts and meat, as well as medicinal plants and herbs. These products, including forest aesthetics, must be considered when managing forests.

The various wood products produced have different product values associated with them. Veneer logs are the highest quality logs. These are usually sliced into thin sheets and used over lower quality material for a fine-looking exterior. Saw logs are processed in a sawmill to produce lumber. Most hardwood lumber is used in furniture, cabinets and paneling. The low-grade center portion, the "cant", of hardwood logs, including much oak, is used for making shipping pallets. Softwood lumber is used primarily for construction.

Pulpwood is made from the poorer quality stems or treetops. Pulpwood is usually ground, flaked or chipped to be used in papermaking or for producing chipboard, flakeboard or particleboard.

Wood products are reusable and recyclable and are made from a renewable resource. Production of wood products requires less energy and produces less harmful by-products than non-wood substitutes. Wood can be grown and harvested from forests on a sustainable basis while protecting all other forest values.

So, when consumers (all humans) choose wood products over non-wood substitutes, they may behelping to reduce waste, pollution and energy consumption.

IV. Forest Management

To understand forest management it is important to understand some of the key terminology. SILVICULTURE is the art and science of manipulating (managing) the forest to achieve a desired future condition. Silviculture is practiced at the stand level. A STAND is an area with generally homogeneous characteristics such as vegetation, age classes, soils, slopes, aspects, etc., usually covering 10 - 100 acres.

Silvicultural systems can be divided into two broad categories:

1. EVEN-AGED.
    - Most trees in the stand are the same age (not necessarily the same size).
    - Some thinnings to improve growth and remove poor quality stems
    - At some point in time (maturity) most trees are harvested
    - A new stand is established
    - Natural regeneration
    - Planting
    - Best for fast-growing, sun-loving (shade intolerant) species
    - Mimics natural processes
    - Tornado blowdown
    - Wide-spread insect mortality or other disease
    - Fires
2. UNEVEN-AGED
    - Trees in stand are of various ages and sizes
    - Stand entered periodically and trees of all sizes are harvested
    - New trees (new age class) must be established after each harvest primarily through natural regeneration
    - Best for slower-growing, shade tolerant species
    - Mimics natural processes
      -gap/phase replacement
      - individual tree mortality
      - individual tree windthrow

Many factors go into determining whether a specific stand should be managed as even- or uneven-aged. These include: landowner objectives, timber type, current age structure, presence or absence of advanced regeneration, forest health, soils, wildlife habitat, aesthetics, landscape considerations, topography/slopes, hydrology/water, deer population, accessibility/transportation and recreational use.

Once all these factors have been considered in conjunction with the landowner's objectives, a forester can develop a silvicultural prescription. Extensive research in silviculture has led to guidelines for prescribing treatments or methods which are most likely to be successful. The prescription will define which trees (if any) should be harvested to meet the landowner's objectives. For the prescription to be implemented, the forester should then recommend how logging should take place, what equipment should be used, how the wood products should be removed from the site, and other measures to protect the future productivity of the site. The forester should then supervise a professional logger in carrying out the prescription in an environmentally sensitive manner. This is how proper forest management should take place.

When done correctly, wood products can be used and the forest will perpetuate itself and continue to provide all of the products of a healthy forest ecosystem. Both forest owners and forest users should strive to work together to minimize conflicts instead of polarizing issues. Research, science, and sustainable principles should be the basis for making forest management decisions, so that our forest can continue to provide a multitude of benefits for centuries to come.

Cross-reference to Eastern Old Growth Forests, River Otter and Fisher Reintroduction in Pennsylvania.

RESTORATION OF RATTLESNAKE HABITAT in Pennsylvania

William B. Allen, Herpetologist, 571 Celeron Street, Pittsburgh, PA 15221
412-242-1362

Two species of rattlesnakes are found in Pennsylvania: the Timber Rattlesnake (Crotalus horridus) and the Eastern Massasauga (Sistrurus catenatus). Each lives in an entirely different habitat. The Timber Rattlesnake prefers the rocky ridges on the south slopes of hilly or mountainous areas. The Eastern Massasauga, on the other hand, hibernates in boggy areas and spends its summer months in adjoining fields at a slightly higher elevation than the bog.

The Timber Rattlesnake has a long life expectancy in the wild, estimated at 25 years or longer, if it has suitable habitat. For many years in Pennsylvania this habitat has been ruined by unscrupulous snake hunters by moving or overturning shelter rocks, or even by pushing the rocks from the top of large ledges. Such shelter rocks are critical for females would spend the warm summer months there incubating their embryos. This type of destruction takes away the snakes' security from predators and their ability to escape the difficult elements of weather, such as rain or extremes of heat and cold. If these shelter rocks are not there, the snakes are forced to move and try to find other shelter. If it is late in the season, there is a good chance that the snakes will be caught out in freezing weather and will die. Professional and serious amateur herpetologists will no longer divulge known denning locations for this reason.

Many old denning sites are no longer as suitable as they used to be, not because of hunting pressure or destruction, but because of growth of trees and underbrush. Young trees of around thirty years age have not been harvested and have created canopies over the ledges, shading them in. On a half-mile ridge, for instance, there may be only eight or ten sites that receive sunlight. These will be the only locations for snake habitat. The gravid females need the sunlight to incubate their young and to bring them to term for the late August or September birthing. Lack of sunlight means lack of warmth, which in turn means no young, cutting the population even further.

This loss of habitat caused by overgrowth has been distressing. Many of the former den sites are on State Game Lands, where all plant and animal life are protected. The State Forester in charge of several of the game lands was contacted and consulted on the problem. Permission was granted to clear some of the sites, after taking the Forester to the sites and reviewing the type of "landscaping" work that needed to be done. The Forester even agreed to provide some labor support and chainsaws! Finding such an official with a liking for snakes was a relief!

Other ledges similar to the ones visited were also known to the Forester, and he offered to take care of them too. He suggested moving the cutting of trees back some 20 feet behind the ledge edge to more fully open up the sites.

Saving snakes from greedy hunters helps to preserve them, but saving and improving habitat is at least as helpful. Snakes are viewed with more tolerance and more interest today. Hikers and bikers are getting into more remote areas where they have a better chance of seeing a rattler or a copperhead. People express more interest in snake natural history, and even if they have never seen one, many now carry cameras to photograph a rare encounter.

Professor William S. Brown, of Skidmore College, published a general reference paper titled "Biology and Conservation of the Timber Rattlesnake" (see reference list below), in which detailed information can be found about rattlesnake habitat restoration.

The Eastern Massasauga is a small, rare rattlesnake. Pennsylvania is in the northeast portion of its range, and it is on the endangered species list for most of the states in the northeastern US. It commonly hibernates in crayfish holes in the winter months. When it emerges in the spring, all covered with mud, it feeds on crayfish and frogs for several months, and then moves to drier territory in an adjoining meadow or field. Here it spends the spring and summer feeding on small rodents such as meadow voles and mice. It is in the meadow where the females lounge about incubating the young. They seek cover beneath the leaves of meadow plants and the goldenrod canopies. This offers them protection from the predators above, such as hawks and owls.

They like damp ground and will even lie out in the rain during the summer. Their habitat is as completely different from that of the timber rattlesnake. The best means of preserving the habitat for this small rattler is by wetland protection.

It is recommended that, if you would like to contribute to rattlesnake preservation, you carry a small folding saw with you on off-trail hikes in the State Game Lands. Obtain permission from the District Forester before you go, and when you encounter overgrown ledges, carefully trim away the underbrush and small overhanging trees to allow the sunlight in. In this way, you too can be part of the effort to maintain these interesting and useful parts of the ecosystem.

References for Rattlesnake Studies

1. William S. Brown, Department of Biology, Skidmore College, Saratoga Springs, NY 12866. 518-584-5000.

Partial list of relevant publications:

   1. Biology and Conservation of the Timber Rattlesnake (1992) in T. F. Tyning, Ed. Conservation of the timber rattlesnake in the northeast, Massachusetts Audubon Society, Lincoln, MA.
   2. Biology, Status and Management of the Timber Rattlesnake (Crotalus horridus). A Guide for Conservation. (1993) Herpetological Circular No. 22-:1-78. Society for the Study of Amphibians and Reptiles.

2. Howard K. Reinert, PhD, Dept of Biology, Trenton State College, Hillwood Lakes, CN 4700 Trenton, NJ 08650-4700
609-771-2474
   1. A profile and impact assessment of organized rattlesnake hunts in Pennsylvania. (1990) J. Pennsylvania Acad. Sci. 64: 136-144

3. Stephen H. Harwig, 247 Kentucky Drive, Lower Burell, PA 15068-2929. 412-335-9931
   1. Personal records
   2. 57 Years of Hunting and Studying the Timber Rattlesnake
   3. Snakes Are Where You Find Them, (1966), a talk presented at the Carnegie Museum of Natural History, Pittsburgh, PA

4. William B. Allen, Jr. 571 Celeron Street, Pittsburgh, PA 15221. 412-242-1362
   1. Poisonous Snakes of Pennsylvania, (July, 1966) PA Game News, published by PA Game Commission.
   2. Timber Rattlesnake, in The Snakes of Pennsylvania (last reprinted 1993) published by Reptile and Amphibian Magazine, Pottsville, PA.
   3. Assorted papers on the Poisonous Snakes of Pennsylvania

5. W. H. Martin, Herpetologist, Rt. 3, Box 84, Harpers Ferry, WVA 25425 304-876-3219
   1. The Timber Rattlesnake: Its Distribution and Natural History (1992), pp 13-22, in T. F. Tyning, Ed., Conservation of the Timber Rattlesnake in the Northeast, Massachusetts Audubon Society, Lincoln, MA.

6. Shadow of Misunderstanding, a video on Pennsylvania rattlesnakes available from the Wild Resources Conservation Fund. See paper #17 for address for ordering.

PENNSYLVANIA'S WILD TURKEY MANAGEMENT PROGRAM: A Success Story

William E. Drake, Wildlife Biologist, PA Game Commission, RD #2, Box 41-D, Kane PA, 176735 814-837-6838

When the early settlers arrived in Pennsylvania, wild turkeys, along with many other wildlife species, were incredibly abundant. However, the advance of frontier civilization caused substantial hardship for many wildlife species including the wild turkey. Year-round subsistence hunting and later, market hunting, depressed turkey populations considerably. Habitat loss from wide scale logging before and after the turn of the twentieth century further deteriorated the status of the wild turkey. By the early 1900's only scattered flocks of wild turkeys remained in the remote portions of the south central mountains of Pennsylvania.

Fortunately, attitudes of unrestricted use of natural resources are being replaced with attitudes directed toward wise use (conservation) of renewable resources. In 1895, the Pennsylvania Game Commission was established. Soon after, legislation was enacted to protect threatened species and efforts to reintroduce or augment others were initiated. Sportsmen were at the forefront of these programs. With legal protection, wild turkey populations began to respond.

Aiding in this response was expansion of suitable forested habitat from second-growth regeneration of old- growth stands which had been cut at the turn of the century. In fact the shade-intolerant species composition of the second-growth stands that resulted in much of northcentral Pennsylvania proved to be superior habitat to that of the old-growth composition (see related paper on this topic in these Proceedings, Paper #10 by Sam Hays, "Eastern Old Growth Forests").

By the 1940's, native wild turkey population levels were increasing and northerly natural dispersal was noted. By the 1970's, wild turkeys had walked and flown to establish viable breeding populations throughout previously inhospitable habitat in the Allegheny Plateau and proceeded further northward into New York State.

In the 1950's, development of the rocket net for capturing wild turkeys proved to be a powerful management tool to expedite turkey population expansion into rapidly developing but unoccupied habitat in eastern and western parts of the state (see maps documenting this expansion in the Atlas of Pennsylvania, p. 64 - 65). Throughout the 1960's, '70's and '80's, transfer of wild turkeys was consistently and phenomenally successful in areas where years of game-farm turkey releases had failed to establish anything but limited "put-and-take" hunting and periodic free meals for predators. Success of these releases also proved that turkeys are able to tolerate less forested, more fragmented habitats and higher human population densities than previously thought.

As of 1989, nearly all habitat suitable for wild turkeys in Pennsylvania was considered occupied. Viable breeding populations of truly wild turkeys are established in every part of Pennsylvania except Delaware and Philadelphia Counties. Harvests are at all time highs and are still increasing.

The Pennsylvania Game Commission's wild turkey management program has been an unqualified success. Future enhancements of our wild turkey resource even further will depend on balancing fall hunting with maintenance of optimum breeding population densities for the existing habitat. In the past, sportsmen and the Game Commission have been the primary influences. The general public needs to be more involved with wild turkey and wildlife management in general. Broader interest and input will result in better management decisions for all citizens of the Commonwealth.

More-broadly-based funding programs, such as "**Teaming With Wildlife**", will result in gains for non-game as well as game resources, the environment and the hunting and non-hunting public.

Bill Drake is the wild turkey biologist for the Pennsylvania Game Commission, which is celebrating 100 years of conservation of Pennsylvania's wildlife species and the habitats on which they (and we humans) depend. Bill was born and completed his primary education in Westmoreland County, PA. In 1959 he graduated from Thiel College with a BA in Business Administration. Following five years in the US Navy, he completed the requirements for an MS in Wildlife Management in the Pennsylvania State University with a thesis on wild turkey movements in relation to habitat and weather.

Bill began his professional career as a Wildlife Biologist for the Vermont Department of Fish and Wildlife in 1968. While in Vermont, he was instrumental in transferring wild turkeys from NY State to Vermont to initiate reestablishment of turkeys in New England.

In 1970 Bill returned to his native state as a Wildlife Biologist with the Pennsylvania Game Commission. His initial studies involved field research and management with forest wildlife species including white-tailed deer and Rocky Mountain elk, along with some involvement with black bear and ruffed grouse.

In 1989 Bill was reassigned to work with wild turkeys. During his six years in this position, he has been involved with various aspects of wild turkey management, but has focused primarily in the area of harvest management.

Additional information regarding this program can be obtained from:

William E. Drake, Wildlife Biologist
PA Game Commission
RD#2, Box 41-D
Kane, PA 16735
814-837-6838

Or

Bureau of Wildlife Management
PA Game Commission
2001 Elmerton Avenue
Harrisburg, PA 17110-9797
717-787-5529

Atlas of Pennsylvania, 1989, Temple University Press, Philadelphia, PA

RESTORING GRASSLAND HABITATS in Pennsylvania

Richard Belding, Land Management Group Supervisor
Pennsylvania Game Commission
RD 2, Box 206, Waynesburg, PA 15370   412-627-9697

(Editorial Note: One of the unending controversies in the field of habitat restoration is the question: Restoration to what base line? Do we try to restore old-growth forests to the conditions that were found at the time of European encounter? Perhaps, but these forests were far from pristine (that is, untouched by human hands) at that time. Native Americans by the hundreds of thousands lived in them and manipulated them, cropping the flood plains, burning the woodlands and changing the animals distribution by their hunting. In this paper, Dick Belding reviews the efforts by several groups of outdoorsmen to return to a very different base line, one of agricultural Pennsylvania of 30 to 50 years ago. It is interesting to note that even this relatively recent man-induced habitat provided an environment for many organisms deemed by more "pure ecologists" to be valuable and in need of protection today.)

For almost 300 years, Pennsylvania's countryside was made up of small farms interspersed with forests. The small fields and pastures were in crops of grain and hay that were havens for many kinds of wildlife. The species known as "small game" found these habitats especially beneficial. Bob-white quail, cottontail rabbits and many song birds thrived in these conditions. In the late 1800's ring-neck pheasants were introduced here from Asia, specifically for hunting, and they too found these conditions just right. Their numbers soared and soon millions were being harvested each year.

Little changed until the mid-1970's. At first the changes were not very noticeable. Wildlife populations had always risen and fallen in rhythm with the severity of weather conditions and the populations of predators, parasites and disease. But this time it was quite different. This time man was involved more directly.

For farmers to compete in the market place, they felt that they had to increase the size of their fields. To do this, they had to clear out the fence rows that divided the fields. For efficient cultivation they had to buy bigger machinery. Each change led to further change. (Editorial note: the identical pressures and the responses to them led, in the climate and topography of the US Great Plains, to the development of the Dust Bowl in the 1930's.)

Contour farming was necessary to control erosion, and one crop was planted right up next to another. Fewer farmers picked their corn only to use the ear, leaving the stalks behind. Instead they chopped the whole stalk and put it in the silo. Varieties of grasses and legumes which would mature faster were used so that more plantings and cuttings could be made during the growing season.

All of these factors interfered with the breeding and nesting cycles of those wildlife species that required standing crops or grasses to be successful. While wildlife has an amazing ability to rebound from non-ideal conditions for a year or two, these continuous pressures were too great. Permanent changes in their habitat made nesting impossible. Small populations of birds and animals continued to hang on, but for the most part populations were in decline. The US Department of Agriculture (USDA) policy of the 1970's to "plow from fence row to fence row" was taking its toll on wildlife.

Coincidentally, at about the same time the USDA introduced another program called "Cropland Reserve" (CRP). This initiative, similar to the Soil Bank of the '60's, paid farmers to take their highly erodable soil out of production and put it into permanent cover such as native grasses. While there was little response to this program in Pennsylvania, in the mid-West hundreds of thousands of acres were taken out of crop production and planted in grasses. The response by wildlife was dramatic. Grassland-nesting birds were able to start reproducing again and did so with great vigor. Quail and ring-neck pheasants led the way. Prior to this time their numbers had dropped to record lows; when proper habitat returned, their numbers exploded again, in some places reportedly to populations exceeding those of the previous highs of the 1940's.

While farmers in Pennsylvania did not immediately respond to the CRP, there are more reasons to do so than improvement of conditions for wildlife. The first one has to be profits. USDA/Penn State University studies (We need a reference to these studies!) have shown that both hay-making and grazing can be improved by incorporation of warm-season grasses (WSG) into plantings. Plants such as switch grass, Indian grass or Bib Bluestem mature later than many present-day hay crops, after early July, giving farmers better weather conditions for harvesting. This gives ground-nesting wildlife time to get their first broods out of the nest before hay is cut. This also extends the harvest season, as more-rapidly maturing crops can then follow the warm-season grasses into the fall.

Some effort has been made by the PA Game Commission (PGC) to plant the open areas of State Game Lands in warm-season grasses. But even complete planting of this relatively small total area would not have much effect on wildlife. The answer has to be in showing farmers how to increase profits by planting their much larger areas in these grasses. Pheasants Forever, a non-profit wildlife organization, realized this and developed a plan to do just this.

A chapter of Pheasants Forever was formed in southwestern PA (Washington, Greene and Fayette counties). They identified the West Pike Run watershed, about 27,000 acres in size, as a place to begin. Many of the farms in this watershed were already enrolled in the PA Game Commission's "Farm Game" program, and the area already had a small pheasant population. Of 22 miles of streams in the watershed, 11 had unrestricted access by cattle. A stream-bank fencing program was started. This not only improves the water quality, but provides winter cover and wildlife corridors as the stream-bank vegetation recovers. Border-edge cuts around fields were offered by the PA Game Commission, which provided both personnel and equipment to make these cuts in the winter time, the dormant season for the grasses. This promotes multiple sprouting of the WSGs, providing better crowing habitat for male pheasants.

Pheasants Forever held a public-education meeting in which farmers were introduced to WSGs. A goal was set to plant at least 1000 acres of demonstration area of WSGs in the watershed. But first, equipment had to be purchased to plant the fluffy seeds of such grasses as Big Bluestem and Indian grass. Fund-raisers were held and raffle tickets were sold on shot guns to raise $12,000 to purchase a Truax grass-seed drill. The purpose of all these efforts is to show what the impact on wildlife would be of implementation of all these different practices... and, coincidentally, how these practices have impacted farm profits.

At the same time these efforts were beginning, the US Fish and Wildlife Service (USFWS) program, Partners in Wildlife, was being introduced into this area by David Putnam, working out of State College, PA. (USFWS, 515 S. Allen St., State College, PA 16801, 814-234-4090). Four sites in other areas of PA have been selected for similar habitat projects by Pheasants Forever chapters or interested landowners, one each in Fayette, Westmoreland, Montour and Berks counties. The Center for Rural Pennsylvania has given a grant to Dr. John Carroll of the Biology Department at the California University of PA to direct a project in planting of WSGs. The grant includes evaluation of the economic impact of the plantings. The Susquehanna Chapter of Pheasants Forever is cooperating with the University of California-PA in establishing 5,000 contiguous acres of additional grassland habitat in southern York County.

Altogether more than $220,000 in both funds and in-kind services have been contributed to these projects. A major part of this support is in the form of a grant under Section 319 of the Clean Water Act, through the PA Dept of Environmental Protection and the US EPA Region III. A wide array of other organizations and agencies is also involved, including the USFWS, the PGC, Pheasants Forever, Ducks Unlimited, California University of PA Biology Department, the USDA Pasture Systems and Watershed Management Research Lab at Penn State University and the National Fish and Wildlife Foundation.

Grassland habitat management is catching on! Funds have come from a variety of sources to purchase 12 Truax seed drills for the Game Commission. Several no-till seeders have also been converted to plant the fluffy seeds. Mining companies see potential for improved strip-mine reclamation with WSGs instead of fescues, because of WSGs better ability to not only persist but thrive in poor soils. Both the PA Dept of Transportation and the PA Turnpike Commission are involved in planting WSGs, not only for their high soil-holding abilities, but for their high aesthetic values. Without creating wildlife hazards along roadsides, conditions can be improved for songbirds and butterflies, in addition to adding to the diversity of plants along our highways.

As this summary is being written, major grant applications are being considered which, if funded, would triple or quadruple the effort to establish WSGs. Farmers are showing increased interest. Once the economic advantages are demonstrated, the result will surely be the planting of many thousands of acres in WSGs.

Am I optimistic? You bet! I can see room again on our farmlands for the meadow larks, bobolinks and dickcissels. When that happens, we'll also see ring-necks, Bob-whites and rabbits in numbers like we remember them. How optimistic am I? I think I'll start me another bird dog pup!

Further information is available from:

Dr. John Carroll, Dept of Biology, California
University of PA, California, PA 15419

US Dept of Agriculture, Pasture Systems, University
Park, PA 16802

Department of Environmental Protection, State of
Pennsylvania, Harrisburg, PA 17107

USEPA, Region III, 841 Chestnut Street, Philadelphia,
PA 19107

Cross reference to papers in these Proceedings on Eastern Old Growth (#10), PA's Wild Turkey Management Program (#14), Wetland Restoration (#11).

TRANSPORTATION IMPACTS ON BIODIVERSITY:
Development of Methodology to Assess when Concern is Necessary

Cynthia Bardman, Environmental Specialist, Greenhorne and O'Mara, Inc.,
1710 Huffs Church Road, Barto, PA 19504 (717-691-3355)

George Reese, Senior Environmental Specialist, GAI, Inc., 570 Beatty Road,
Monroeville, PA 15146-1399 (412-856-6400)

The methodology for assessing impacts from transportation projects on biodiversity is only in its early developmental stages. A draft of a proposed methodology will be presented for the first time at the January, 1997, annual meeting of the Transportation Research Board, in Washington, DC.

The phrase "biological diversity", often shortened to "biodiversity", is an umbrella term used to describe the number, variety, and variability of living organisms in a given system. The term encompasses the numbers and relative abundance of different ecosystems, species and genes. Decline in biodiversity includes all those changes that have to do with reducing or simplifying biological heterogeneity, from individuals to regions. Biodiversity has important bearings on ecological processes, cultural heritage, recreation and tourism, agricultural and other harvested resources, and so forth. The intrinsic importance of biodiversity lies in the uniqueness of all forms of life: each individual is different, as are each population, each species and each association of species.

The issue of biodiversity has recently received national and worldwide attention. The impact of development on biodiversity is emerging as a concern of environmental groups, and some transportation agencies have begun addressing those concerns in various ways. The issue goes beyond consideration of the effects of development on wildlife (such as threatened or endangered species) or on wetlands, as has been done routinely in NEPA (National Environmental Policy Act) documents for transportation projects. This is a relatively new issue, and there is no regulatory mandate yet in place for transportation agencies to do biodiversity assessments. However, the concern is of sufficient magnitude that it seems prudent to take the time now to develop rational and practical guidance to use on transportation projects when there are real risks of impacts to biodiversity.

Natural landscapes are typically composed of a mosaic of habitats differing in size, shape, structure and composition. Human activities such as the construction of power lines, housing developments and roadways usually produce habitat fragmentation, resulting in a modification of that mosaic. Transportation agencies are particularly interested in evaluating the effects on biodiversity of this fragmentation caused by linear projects.

To properly perform such an assessment, what is needed is detailed information on species richness and on the distribution and condition of habitats and species within areas. This information must be germane to both the immediate effects of the construction and the long-term effects of active corridors.

The Transportation Research Board (TRB) Task Force on Transportation and Natural Resources is currently evaluating the importance of these issues. When completed, their evaluation will be made available to State and Federal agencies for incorporation into their planning analysis. This evaluation will be made in four general sections:

1. The general concept of biodiversity and what issues are of concern to environmental groups.
2. The current state of the art for transportation agencies when they attempt to address these concerns.
3. Recommendations on evaluating project impacts on biodiversity, including what types of projects should be evaluated and what type of analysis is appropriate.
4. Development of the methods for evaluation of project impacts on biodiversity.

The evaluation of project impacts will be based on a series of "if/then" decision statements, with background information and discussion for each of four particular decisions.

The first of these will be to question whether the existing environment of the project warrants analysis to determine its biodiversity features. For example, **If** the transportation project is located within an urbanized area, an area where transportation corridors already exist, an area of low biodiversity... **Then** analyses of existing biodiversity features should not be made. **If** the proposed project is located with a forested area, a recognized natural area, an undisturbed area... **Then** analyses of existing biodiversity should be made. Appropriate analyses may include habitat mapping, estimation of species richness, patch size and connectivity, and other landscape-level features that can be assessed with the aid of remote sensing and Geographical Information Systems (GIS).

The second decision will be as to whether biodiversity will be permanently or temporarily impacted by the proposed project. For example, **If** threatened or endangered species habitat or other specific "important" types of habitat are to be permanently or temporarily disrupted... **Then** permanent or temporary impacts to biodiversity will occur. Such impacts include direct ones such as physical habitat loss or alteration, or indirect ones such as increases in noise level, disruption of behavior patterns, and so forth.

The third decision will be as to whether or not secondary impacts to biodiversity will occur. For example, **If** the proposed project will induce development within the area or induce modification of zoning ordinances... **Then** cumulative or secondary impacts to biodiversity may occur. Further analysis of these impacts is then warranted

The fourth and final decision will be as to whether mitigation of the expected impacts is warranted. This section will include discussion of mitigation options, such as the revision of a project to lessen or avoid the impacts, as well as measures to restore or replace habitat.

Those interested in the continued development of this methodology should contact the agencies listed below:

1. Pennsylvania Department of Transportation,
   Bureau of Environmental Quality,
   Transportation and Safety Building,
   Room 1009,
   Harrisburg, PA. 17120
   Attn. Toni Zawisa 717-787-1025

2. National Research Council,
   Transportation Research Board,
   2101 Constitution Ave.,
   Washington, DC 20418
   Attn: Jon Williams
   202-334-2933

Cross-reference to the following papers in these Proceedings: Eastern Old-Growth (#10), Timber Harvesting (#12), Wetland Restoration (#11).

THE ROLE OF THE WILD RESOURCE CONSERVATION FUND: How It Helps in the Implementation of Restoration Projects

Frank Felbaum, Executive Director
Wild Resource Conservation Fund,
PO Box 8764, Harrisburg, PA 17105-8764
717-783-1639/-9067(fax)

Until 1983 there was no formal state-level effort to understand and protect the non-game wildlife and plant resources of Pennsylvania. Supported entirely by voluntary contributions, the Wild Resource Conservation Fund is the only such program in the entire country to include its native plants as well as its animal population in its management plan.

In the past, hunting license fees have been the sole source of funds to manage our game lands and animals. Now there are several sources for support of the entire remainder of the wild biological community. These sources include the State income-tax check-off (donating part of any refund to which you might be entitled to the Wild Resource Conservation Fund), voluntary direct contributions, and the very successful Wild Resource license plates. Some 250,000 of these have been sold. Of the $35 license fee, $15 goes to the Fund. And the Fund has produced a range of exceptional video tapes and books, all of which also go to support the Fund. (An order blank is printed at the end of this Proceedings volume).

The Fund is administered by the heads of the Department of Conservation and Natural Resources, the Game Commission, the Fish and Boat Commission, and the chairmen of the Senate Natural Resource Committee and the House Conservation Committee. There is also a broad-based Advisory Committee to supply professional support for decision-making.

The Fund has been involved in supporting many of the projects included in this volume. The reintroduction of otters and fishers (Paper #4) and the reintroduction of ospreys (Paper #7) are two of the best known examples. But during the last year there have been over 30 other projects across the state that focused on mammals, plants, insects, birds, reptiles, amphibians and fish... the entire gamut of biological diversity in the State, and in virtually every corner of the State. Over the years, WRCF has spent millions of dollars to inventory the diversity of the state.

One of the best ways to become acquainted with the broad range of these activities is to subscribe to Keystone Wild Notes, a quarterly tabloid devoted to sharing this kind of information. For a subscription, contact the Editor, Keystone Wild Notes, WRCF, PO Box 8764, Harrisburg, PA 17105.

Let's look at a truly fundamental project in which the Fund has been an essential player: the Pennsylvania Natural Diversity Inventory (PNDI). A classic problem for ecologists is to establish base line information, the data that document some point of reference. If we do not know what was in an ecosystem some years ago, how can we be certain that today it has changed under the stress of pollution? This exact case is facing us now as we try to understand the effects of acid rain on the aquatic organisms in the streams of Pennsylvania. For many years scientists tended to look only at populations of larger game fish as indicators of stream health. More recent studies supported by the Fund show that many smaller non-game species have been disappearing from our streams before any indication of a problem showed up in the larger species. Thus a knowledge of the full diversity of life forms helps us to establish which ones are most sensitive to the stresses that human activities may be placing on the system as a whole.

And that is precisely what the PNDI is about: locating and describing community types across the State, with a special emphasis on threatened systems. In the past, emphasis has been placed on protecting individual species. Today it is recognized that a much more effective approach would be to catalog the State's entire natural heritage, with an eye toward "endangered species prevention". Having this sort of inventory, planners at all levels, from individual land-owners to government agencies, can make decisions on location of timber harvests, new roads or parks and so forth. Without it, such informed decisions are impossible.

The PNDI is a joint project of the Nature Conservancy, the Western Pennsylvania Conservancy, and the PA. Bureau of Forestry. Money from the Wild Resource Conservation Fund has been important in developing and maintaining PNDI over the years.

One of the growing realizations in the past few years is the role of "decomposers" in the forest. And yet the "charismatic megafauna" get most of the attention. Otters are so cute! There are no zoos for micro-fauna, but that doesn't make them any less important in the chain of species diversity. The Fund provides support for development of comprehensive checklists of algae and fungi that identify and list the locations of the hundreds of types of these organisms across Pennsylvania. Future researchers will be able to use these lists to monitor the status of these organisms or explore their role in the ecosystem.

Perhaps the most visible of all the projects the Fund has been involved with has been the restoration of river otters and fishers to the streams and forests of the State. These members of the weasel family were extirpated in the State in the late 19th and early 20th centuries by trapping and by loss of habitat. As the forests have grown back, habitat once again became available and led by Dr. Tom Serfass, of Penn State University, a long-term concerted effort has been carried out to develop techniques for reintroduction. This story is told in detail in Paper #4 of this volume. The story is particularly interesting because most of the top of the food chain, the predators, has been "extirpated" in Pennsylvania, including wolves and mountain lions, ospreys and eagles, and until recently, also these remarkable smaller mammals. Their reintroduction into the forests and streams helps to restore a balance between the land and its occupants, fulfilling a vital function we humans cannot carry out ourselves. This is particularly clear as we look at the huge problems created by excess populations of white-tailed deer, for whom there are no longer any predators, and by the spread of exotic plants, crowding out the native species.

That latter point reflects on another interesting project described in this volume, the control of purple loosestrife, an exotic plant, by the introduction of an exotic beetle which preys on the loosestrife! (See Paper #9). The Fund is watching this project closely, illustrating another role the Fund plays: that of clearinghouse for information on projects of all kinds related to the State's natural diversity. And of course, the Fund has been pleased to support the publication of this Proceedings volume, expecting that it will act as a stimulus to similar activities in other areas.

Cross reference to papers in these Proceedings: Reintroduction of River Otters and Fishers (Paper #4), Osprey Reintroduction (Paper #7), Biological Control of Purple Loosestrife (Paper #9), The French Creek Project (Paper #5), Reintroduction from the Zoo's Point of View (Paper #3), American Shad (Paper #8), Bluebirds (Paper #6), Wild Turkey Management (Paper #14).

Do Something Wild!

Make a donation to protect Pennsylvania's wildlife and choose a gift for yourself or a friend.

Books

- ☐ **Proceedings of the Conference on Wildlife Reintroduction and Habitat Restoration in Pennsylvania.** A $5.00 donation is suggested.
- ☐ **A Viewer's Guide to Pennsylvania Wildlife.** *A comprehensive guide to the best places in the state to watch wildlife.* A donation of $20 is suggested.
- ☐ **Pennsylvania Reptiles and Amphibians.** *A guide to the identification, habitat,and life histories of the state's reptiles and amphibians. Includes full-color drawings and maps.* A donation of $20 is suggested.
- ☐ **Woodworking for Wildlife.** *A handyman's guide to building everything from bird houses to a duck loafing platform.* A $3 donation is suggested.
- ☐ **Pennsylvania's Natural Beauty.** *A coffee table book which takes the reader on a visual journey through forest, falls and flowers on state land with award-winning photographer Blair Seitz.* A donation of $30 is suggested.

Souvenirs

- ☐ **Wild Resource Conservation Fund baseball cap.** A $20 donation is suggested.
- ☐ **Wild Resources Conservation Fund coffee mug.** A $10 donation is suggested.

Videos

- ☐ **Season of the Bat.** *The story of Pennsylvania bats.* A $20 donation is suggested.
- ☐ **The Homecoming.** *Bringing river otters back to the state's waterways.* A $20 donation is suggested.
- ☐ **Return from Forever.** *The story of the osprey re-introduction program.* A $20 donation is suggested.
- ☐ **Shadow of Misunderstanding.** *The story of Pennsylvania's rattlesnakes.* A $20 donation is suggested.
- ☐ **Pennsylvania's Wild Garden.** *Join botanists to learn about the variety, and value, of the state's plant diversity.* A $20 donation is suggested.

Yes! I want to 'do something wild' and help protect Pennsylvania's natural heritage. Please send me the items marked. My check includes a donation of _______ to help preserve our wild plants and animals.

Name ______________________________

Address: ____________________________

____

City: ______________________________

State: ________________ **Zip:** ________

Mail to:
Wild Resources Conservation Fund
P.O. Box 8764
Harrisburg, PA 17105-8764

Make checks payable to:
"Wild Resource Conservation Fund"

All proceeds benefit Pennsylvania's native plants and wildlife.

Do Something
WILD!

Publication of Conference Proceedings was printed
Courtesy of
Wild Resource Conservation Fund